Exhibit O - Radiological Work Plan 2007

DEPARTMENT OF THE NAVY
BASE REALIGNMENT AND CLOSURE
PROGRAM MANAGEMENT OFFICE WEST
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Ser BPMOW.rep/0017
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Dear Regulatory Team Members:

Please find included as Enclosure 1 the Base Wide Radiological Work Plan, Revision 1, Hunters Point Shipyard, San Francisco, CA for your information.

Should you have any concerns with this matter, please contact Ralph Pearce at (619) 532-0912 or Keith Forman at (619) 532-0913.

Sincerely,

KEITH FORMAN
BRAC Environmental Coordinator
By direction of the Director

Enclosures: 1. Base Wide Radiological Work Plan, Revision 1, Hunters Point Shipyard, San Francisco, CA, dated 10/5/2007.

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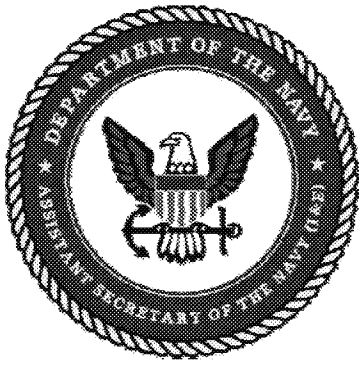

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BASE-WIDE RADIOLOGICAL WORK PLAN

Revision 1
October 5, 2007

HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA

BASE-WIDE RADIOLOGICAL WORK PLAN

Revision 1
October 5, 2007

HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA

DCN: FWSD-RAC-05-0165.R1

Prepared for

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CONTRACT NO. N62473-06-D-2201
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ABBREVIATIONS, ACRONYMS, AND SYMBOLS

µR/hr	microroentgen per hour
α	alpha
β	beta
AEC	Atomic Energy Commission
AHA	Activity Hazard Analysis
ALARA	as low as reasonably achievable
BAAQMD	Bay Area Air Quality Management District
Bay	San Francisco Bay
BHASP	Building Health and Safety Plan
BMP	Best Management Practice
BRAC PMO	Base Realignment and Closure Program Management Office West
Caltrans	California Department of Transportation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CHP	Certified Health Physicist
CIH	Certified Industrial Hygienist
cm	centimeters
cm^2	square centimeters
cm/s	centimeters per second
CMT	Construction Management Technician
COC	chain-of-custody
^{60}Co	cobalt-60
cpm	counts per minute
CPR	cardiopulmonary resuscitation
CQC	Contractor Quality Control
^{137}Cs	cesium-137
CSO	Caretaker Site Office
CTO	Contract Task Order
D&D	decontamination and decommissioning
DAC	derived air concentration

ABBREVIATIONS, ACRONYMS, AND SYMBOLS
(Continued)

DCGL	derived concentration guideline level
DFW	definable feature of work
DoD	Department of Defense
DON	Department of the Navy
DOT	Department of Transportation
dpm	disintegrations per minute
DQO	data quality objective
EHS	Environmental Health and Safety
EM	Engineer Manual
EPA	U.S. Environmental Protection Agency
EPP	Environmental Protection Plan
FCR	Field Change Request
FSS	Final Status Survey
g/cm^3	grams per cubic centimeter
GPS	Global Positioning System
G-RAM	general radioactive material
HPS	Hunters Point Shipyard
HRA	Historical Radiological Assessment
IR	Installation Restoration
ISO	International Organization for Standardization
keV	kiloelectron volt
LBGR	lower boundary of the gray region
m	meters
m^2	square meters
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDC	minimum detectable concentration
MDCR	minimum detectable count rate
MDER	minimum detectable exposure rate
MeV	megaelectron volt
min	minutes

ABBREVIATIONS, ACRONYMS, AND SYMBOLS
(Continued)

mrem/y	millirem per year
m/s	meters per second
MSDS	Material Safety Data Sheet
NaI	sodium iodide
NAVSEA	Naval Sea Systems Command
NCR	Nonconformance Report
NFECSW	Southwest Division, Naval Facilities Engineering Command
NIST	National Institute of Standards and Technology
NRDL	Naval Radiological Defense Laboratory
NRC	Nuclear Regulatory Commission
NTR	Navy Technical Representative
NWT	Northwest Technologies, Inc.
OSHA	Occupational Safety and Health Administration
pCi/g	picocuries per gram
pCi/L	picocuries per liter
pCi/mL	picocuries per milliliter
PjM	Project Manager
PPE	personal protective equipment
PQCM	Project Quality Control Manager
PRG	Preliminary Remediation Goal
QAO	Quality Assurance Officer
QC	quality control
QCM	Quality Control Program Manager
^{226}Ra	radium-226
RADLAB	Radiation Laboratory
RASO	Radiological Affairs Support Office
RCP	Radiological Control Plan
RCT	Radiological Control Technician
ROICC	Resident Officer in Charge of Construction
RPM	Remedial Project Manager

ABBREVIATIONS, ACRONYMS, AND SYMBOLS
(Continued)

RSO	Radiation Safety Officer
RSS	Radiological Safety Section
RSSI	Radiation Survey and Site Investigation
RTM	Radiation Task Manager
RTS	Radiological Task Supervisor
RWP	Radiation Work Permit
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SFRA	San Francisco Redevelopment Agency
SHSP	Site Health and Safety Plan
SHSS	Site Health and Safety Specialist
SOP	Standard Operating Procedure
^{90}Sr	strontium-90
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	Stormwater Resources Control Board
Triple A	Triple A Machine Shop, Inc.
TSP	Task-specific Plan
TtEC	Tetra Tech EC, Inc.
TtFW	Tetra Tech FW, Inc.
^{235}U	uranium-235
VSP	Visual Sample Plan
WRS	Wilcoxon Rank Sum (test)

1.0 INTRODUCTION

This Base-wide Radiological Work Plan (Base-wide Plan) describes survey and decontamination approaches that will be implemented in support of radiological release of buildings and areas at Hunters Point Shipyard (HPS), San Francisco, California. Tetra Tech EC, Inc. (TtEC), formerly known as both Tetra Tech FW, Inc. (TtFW) and Foster Wheeler Environmental Corporation, has been contracted by the Department of the Navy (DON) to perform these activities at HPS for the Base Realignment and Closure Program Management Office West (BRAC PMO) under Southwest Division, Naval Facilities Engineering Command (NFECSW) Remedial Action Contracts.

A basic concept in radiation protection specifies that exposures to ionizing radiation and releases of radioactive material should be managed to reduce collective doses to workers and the public and ensure that exposure is as low as reasonably achievable (ALARA). The ALARA principle will be considered during the course of the work carried out under the Base-wide Plan for survey activities.

The Base-wide Plan will be used to conduct the following activities in support of radiological surveys. The objectives of these activities are to evaluate impacted sites that may contain residual radioactive contamination as a result of past activities at HPS, clean up identified radioactive contamination, and confirm that buildings and sites at HPS meet the release criteria. These activities include:

- Reference (Background) Surveys
- Scoping Surveys
- Characterization Surveys
- Remedial Action Support Surveys
- Final Status Surveys (FSSs)
- Personnel Surveys
- Equipment and Material Surveys
- Truck Surveys
- Media Sampling
- Air Sampling
- Decontamination and Dismantling
- Radioactive Materials Management

Where applicable, survey activities will be conducted consistent with the guidelines in the *Multi-Agency Radiation Survey and Site Investigation Manual* (Multi-Agency Radiation Survey and Site Investigation Manual [MARSSIM]; Nuclear Regulatory Commission (NRC) NUREG-1575; Department of Defense [DoD] et al., 2000), as incorporated into this Base-wide Plan. Survey activities as well as activities not addressed by MARSSIM will be performed in accordance with this Base-wide Plan and the Standard Operating Procedures (SOPs) presented in the *Hunters Point Shipyard Base-wide Radiological Control Plan* (RCP) (TtFW, 2004a).

The Base-wide Plan is organized as follows:

- **Section 1.0, Introduction** – Section 1.0 provides an overview of the project scope, work objectives, and organization of the Base-wide Plan.
- **Section 2.0, Background** – Section 2.0 presents a description of HPS, a historical summary of the shipyard, and an overview of the radiological history of HPS, including sites identified as impacted in Volume II of the Historical Radiological Assessment [Naval Sea Systems Command (NAVSEA), 2004].
- **Section 3.0, Project Management** – Section 3.0 discusses the project organization, roles and responsibilities of key project personnel, personnel qualifications, and work control activities, including Radiation Work Permits (RWPs).
- **Section 4.0, Radiological Surveys** – Section 4.0 identifies the types of surveys that will be conducted, and discusses survey area classification and survey type selection.
- **Section 5.0, Survey Planning and Design** – Section 5.0 presents the survey strategies and data quality objectives.
- **Section 6.0, Release Criteria** – Section 6.0 identifies the criteria for radiological release from structures and areas.
- **Section 7.0, Instrumentation** – Section 7.0 identifies instrumentation that will be used to perform surveys.
- **Section 8.0, Survey Implementation** – Section 8.0 presents the approach to implementing surveys that will be conducted as well as associated sampling activities.
- **Section 9.0, Decontamination and Dismantling** – Section 9.0 discusses the survey and construction activities that will be implemented to perform remedial action at sites contaminated by radiation above release limits.
- **Section 10.0, Radioactive Materials Management** – Section 10.0 describes how radioactive materials will be managed, including control of samples, work areas, and wastes.
- **Section 11.0, Documentation and Records Management** – Section 11.0 presents procedures that will be used to manage records/documentation, as well as to assess, interpret, and report data.

- **Section 12.0, Environmental Protection Plan** – Section 12.0 identifies potential environmental impacts that will be considered during project implementation and how they will be managed.
- **Section 13.0, Quality Assurance/Quality Control** – Section 13.0 provides the methods and means that will be employed to ensure a consistent approach to achieving project quality goals.
- **Section 14.0, References** – Section 14.0 presents references cited in the Base-wide Plan.
- **Appendix A, Example Radiation Work Permit** – Appendix A presents an example RWP.
- **Appendix B, Base-wide Sampling and Analysis Plan** – The Sampling and Analysis Plan summarizes the protocols for collecting, tracking, and analyzing samples collected under this plan.

Task-specific Plans (TSPs) will be prepared for each survey and remediation performed under the Base-wide Plan. These TSPs will supplement the information provided in the Base-wide Plan. Each TSP will provide relevant location-specific data and identify variances and/or additions to the Base-wide Plan. Substantial deviations from the Base-wide Plan may result in the generation of a stand-alone, job-specific work plan. Where prepared, these stand-alone work plans would supersede this Base-wide Plan.

2.0 BACKGROUND

2.1 SITE LOCATION AND DESCRIPTION

The HPS site lies entirely within the corporate boundaries of the City and County of San Francisco, California, near the County's southern boundary with San Mateo County (Figure 2-1). HPS is located on San Francisco Bay in the southeast corner of San Francisco. The site encompasses approximately 848 acres, including approximately 416 acres on land, at the point of a high, rocky, 2-mile-long peninsula projecting southeastward into San Francisco Bay (the Bay).

HPS is divided into six parcels (Figure 2-1); Parcels A through E encompass onshore areas and Parcel F comprises offshore areas. In November 2004, Parcel A was transferred to the City and County of San Francisco. In 2004 the DON subdivided Parcel E, creating Parcel E-2. Radiologically impacted sites that will be addressed under this Base-wide Plan are located in Parcels B, C, D, E, and F.

2.2 GENERAL SITE HISTORY

Commercial shipyard activity has taken place on the Hunters Point peninsula since 1868 when the first drydock on the Pacific Coast was constructed there. By 1939, two drydocks and associated support facilities were located on Hunters Point. The DON purchased the drydocks and surrounding land from Bethlehem Steel in 1939 and occupied the site in late 1941, creating Hunters Point Naval Shipyard. After a significant expansion and buildup during World War II (including the construction of four additional drydocks) the shipyard diversified as a major fleet support center performing ship repair throughout the Korean Conflict. The shipyard operated as a general repair facility specializing in submarines, aircraft carrier overhaul, and ship repair operations through the early 1970s. The workload consisted primarily of the repair and conversion of conventionally powered ships, repair of diesel submarines, and non-radiological work on nuclear-powered ships.

The DON deactivated HPS in 1974 and most of the site was then leased to a commercial ship repair company, Triple A Machine Shop, Inc. (Triple A) from 1976 to 1986. Triple A dedicated more than 80 percent of the shipyard to the repair of commercial and naval vessels and subleased unused facilities to private warehousing, industrial, and commercial firms. In 1986, the DON again assumed control of the shipyard and used it for the docking and repair of several DON surface ships.

In 1991, HPS was selected for closure pursuant to the terms of the Defense Base Closure and Realignment Act of 1990. The property will be transferred to the City and County of San Francisco for non-defense use. Closure activities at HPS involve environmental remediation activities to make the property suitable for transfer. Currently, BRAC PMO manages the HPS

property. Routine access to the property is controlled by the San Francisco Redevelopment Agency (SFRA) under an agreement with the DON.

Hazardous materials are present at HPS because of previous shipyard operations. Investigation and cleanup of contamination at HPS by the DON has been underway since the 1980s. In 1989, the U.S. Environmental Protection Agency (EPA) placed HPS on the National Priorities List as a Superfund site pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA).

Some of the tenants that sublet from Triple A are still operating at HPS, now under direct leases with the DON, which has also leased space to SFRA, which in turn sublets space to various artists for studios and to divisions of the City of San Francisco Police Department. A limited number of DON-related entities also maintain operations at the site.

2.3 RADIOLOGICAL HISTORY

As part of the environmental investigations being performed to facilitate transfer of HPS, the DON has prepared a Historical Radiological Assessment (HRA) that documents the history of radiological materials at HPS. The HRA is presented in two volumes. Volume I (NAVSEA, 2000) addressed radioactivity associated with the Naval Nuclear Propulsion Program and concluded that berthing of nuclear-powered ships at HPS or work done on these ships resulted in no adverse effects on the human population or the environment. Volume II (NAVSEA, 2004) presented the history of general radioactive material (G-RAM) at HPS in three primary operational areas:

- Use of G-RAM at HPS by the naval shipyard and Triple A
- Decontamination activities associated with ships that participated in atomic weapons testing including OPERATION CROSSROADS
- Radiological activities associated with the Radiation Safety Section/Radiation Laboratory/Navy Radiological Defense Laboratory

Volume II concluded that areas of known or potential radiological contamination are present at HPS and identified additional investigation and/or cleanup activities to support the transfer and reuse of the base. This Base-wide Plan has been prepared to address the recommendations presented in Volume II of the HRA.

The HRA states that, beginning in the late 1930s, devices incorporating radioluminescent radium paint came into wide use in the Navy. These devices constituted the first G-RAM introduced to

HPS. Other G-RAM used at HPS as part of routine shipyard activities included:

- Other radioluminescent devices
- Gamma sources for gamma radiography
- Sources for calibrating radiation-detection instruments
- Materials found in items such as smoke detectors, welding rods, and night vision equipment

The use and/or handling of these materials could have resulted in radiological contamination at HPS.

Some of the ships that participated in atomic weapons testing, including OPERATION CROSSROADS, were brought to HPS for decontamination. OPERATION CROSSROADS involved detonating two atomic bombs at Bikini Atoll in July 1946. During these tests, a number of ships at the atoll became contaminated with radioactive materials. The DON concluded that a shipyard environment would be needed to decontaminate many of these ships and HPS was selected as the principal location for this activity. Consequently, contaminated ships were involved in experimental decontamination efforts at HPS. Decontamination of these ships and ships involved in other atomic weapons testing was conducted by mechanical methods, such as scraping or sandblasting, and/or chemical methods, such as acid washing. Decontamination activities and/or the associated waste disposal could have resulted in radiological contamination at HPS.

In 1946, the DON created an organization tasked with applying radiological safety throughout the Navy. Initially known as the Radiological Safety Section (RSS), this unit was briefly renamed the Radiation Laboratory (RADLAB) and ultimately became the Naval Radiological Defense Laboratory (NRDL) in 1948. The unit was established at HPS with the original mission of supporting the decontamination efforts on OPERATION CROSSROADS ships. By the time the unit became the NRDL, the mission had expanded to include the study of nuclear weapons effects and development of methods for the protection of DON personnel and ships. From the 1950s until 1969 when it was closed, NRDL was recognized as a leading radiological research facility. The breadth of the research performed by NRDL included the use of a large number of radionuclides. The use of these materials and the disposal of wastes generated during research activities could have resulted in radiological contamination at HPS.

In accordance with MARSSIM (NUREG-1575; DoD et al., 2000), an "impacted site" is defined as one that has a potential for radioactive contamination based on historical information or is known to have radioactive contamination. Based on the review of historical information regarding radiological operations at HPS, the HRA concluded that 91 impacted sites were associated with HPS.

The HRA recommends 56 sites at HPS for further investigation and remediation by the DON. However, since publication of the HRA, the Navy has also identified several additional sites that require investigation. These include buildings, drydocks, former building sites, outdoor areas, Installation Restoration (IR) sites, ships' berths, the Gun Mole Pier, and the sanitary and storm sewer systems. Specific recommendations for surveys and/or cleanup at each of the 56 areas are presented in the HRA and summarized in Table 2-1, while any additional sites will be characterized accordingly. This Base-wide Plan will provide the basis for conducting these activities. As appropriate, individual, location-specific, or stand-alone work plans may be prepared for one or more of these sites. Where prepared, these stand-alone work plans would supersede this Base-wide Plan.

TABLE 2-1

SUMMARY OF SITES IDENTIFIED FOR FURTHER ACTION BY THE DON

Building Number or Area	Recommended Action in HRA				Isotopes of Concern								
	Scoping Survey	Characterization Survey	Remediation	Final Status Survey	Am-241	Co-60	Cs-137	H-3	Pu-239	Ra-226	Sr-90	Th-232	U-235
Parcel B													
114	X						X			X	X		
140 and Discharge Tunnel	X	X	X	X			X		X	X	X		
142	X	X	X	X			X		X	X	X		
146		X	X	X			X			X	X		
157	X	X	X	X		X	X			X			
IR-07	X	X	X	X			X		X	X	X		
IR-18	X	X	X	X			X		X	X	X		
Drydock 5	X	X	X	X			X		X	X	X		
Drydock 7	X	X	X	X			X		X	X	X		
Parcel C													
203	X	X	X	X			X		X	X	X		
205 and Discharge Tunnel	X	X	X	X			X		X	X	X		
211			X	X			X			X		X	
253		X	X	X			X		X	X	X	X	
Parcel D													
351A			X	X			X		X	X	X	X	
364			X	X		X	X		X	X	X		X
366/351B			X	X			X			X	X		
408	X	X	X	X						X			
813	X	X	X	X							X		
819	X	X	X	X			X			X			
Parcel E													
500	X	X	X	X			X			X			
500 Building Series	X	X	X	X	X		X		X	X	X		
503 Site	X						X			X	X		
506 Site	X	X	X	X	X		X	X	X	X	X		
507 Site		X					X		X	X	X		
508 Site		X	X	X			X			X	X		
509 Site		X	X	X			X				X		
510 Site		X	X	X	X		X		X	X	X		
510A Site		X	X	X			X				X		
517 Site		X	X	X		X	X				X		
520 Site		X	X	X			X			X	X		
521	X						X		X	X	X		
529 Site		X	X	X			X	X		X	X		
704 Area	X						X		X	X	X		
704 Pens	X						X			X	X		
707/Kennel		X	X	X			X		X	X	X		
707B Site		X	X	X			X			X	X		
707C Site		X	X	X			X		X	X	X		
707 Triangle Area		X	X	X			X		X	X	X		X
719 Site	X	X		X			X			X	X		
807 Site	X	X		X			X			X	X		
810	X	X	X	X			X			X	X		
Shack 79 Site		X	X	X			X			X	X		
Shack 80 Site			X	X			X			X	X		
Experimental Shielding Range			X	X		X	X			X			
IR-01/21, Industrial Landfill			X	X			X			X	X		
IR-02, Bay Fill		X	X	X			X			X	X		
IR-03	X	X	X	X			X			X	X		
IR-04		X	X	X			X			X	X		
Former Salvage Yard	X	X	X	X			X			X	X		
Shoreline		X	X	X			X			X	X		
Base-wide													
Storm Drain Lines	X	X	X	X			X			X	X		
Sanitary Sewers	X	X	X	X			X			X	X		
Septic Systems	X	X	X	X			X			X	X		
Parcel F													
Underwater Areas	X						X		X	X	X		X
Ship's Berths	X						X		X	X	X		
Off-site Facility													
ICW 418	X						X			X	X		

Notes:
DON - Department of the Navy
HRA - Historical Radiological Assessment
AM-241 - americium-241
CO-60 - cobalt-60
Cs-137 - cesium-137
H-3 - hydrogen-3
Pu-239 - plutonium-239
Ra-226 - radium-226
Sr-90 - strontium-90
Th-232 - thorium-232
U-235 - uranium-235

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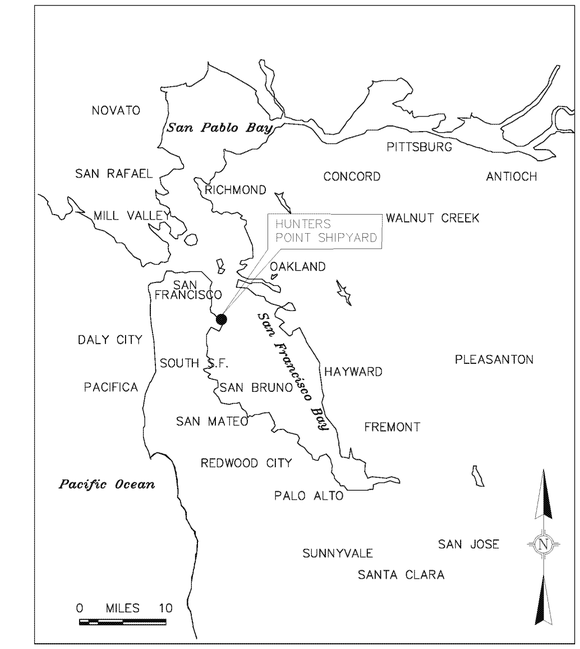
APPROVED BY: WED

CHECKED BY: RNA | REV: 1

DRAWN BY: AEC | DATE: 10/08/07

OFFSITE FACILITY: ISLAIS CREEK
WAREHOUSE 418



KEY MAP

- NAVY PROPERTY BOUNDARY (OFFSHORE)
- PARCEL BOUNDARY
- IMPACTED BUILDINGS OR SITES
- DEMOLISHED IMPACTED BUILDINGS/STRUCTURES
- DEMOLISHED BUILDINGS/STRUCTURES
- IMPACTED UNDERWATER AREA
- IMPACTED FUDS SITES
- IMPACTED SITES THAT HAVE OBTAINED REGULATORY RELEASE
- NON-IMPACTED BUILDINGS WITHIN AN IMPACTED SITE, RADIOLOGICAL PRECAUTIONS MAY BE REQUIRED
- IMPACTED SANITARY SEWER SYSTEM
- IMPACTED STORM DRAIN SYSTEM

NOTE:

FOR PLANNING PURPOSES, THE STORM DRAIN & SANITARY SEWER SYSTEMS SHOULD BE CONSIDERED IMPACTED.

STORM DRAIN AND SANITARY SEWER LINE LOCATIONS BASED ON DATA FROM HPS CSO (1995) AND THE FINAL HRA (AUG 2004) THAT HAVE NOT BEEN FIELD CHECKED.

FIGURE 2-1
BASE-WIDE WORK PLAN

HUNTERS POINT SHIPYARD-SAN FRANCISCO, CA

TETRA TECH FW, INC.

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3.0 PROJECT MANAGEMENT

3.1 INTRODUCTION

This section describes management of the project including organizational, structural, and functional responsibilities; the use of RWPs; prerequisite requirements of survey activities; and client notifications.

3.2 ORGANIZATION

The project personnel will be organized to facilitate effective communications and to ensure that organizational lines of communications, roles and responsibilities, and reporting requirements are well defined. The organization will be defined to a level sufficient to ensure that each participant whose actions could affect the quality of radiological task planning, field or laboratory operations, or reporting, has an understanding of his/her responsibilities and how these responsibilities fit into the overall team. The project organization chart is provided in Figure 3-1. The following table provides contact information of DON and key project personnel.

Agency	Contact	Project Title
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Agency	Contact	Project Title
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Tetra Tech EC, Inc. 1230 Columbia St., Suite 750 San Diego, CA 92101-8536	Mr. Roger Margotto (619) 471-3503 (714) 810-3742 (pager) roger.margotto@tteci.com	Certified Industrial Hygienist (CIH)
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Tetra Tech EC, Inc. Hunters Point Shipyard 270 Nimitz Ave. (Bldg. 270) San Francisco, CA 94124.	Mr. Brad Wheeler (415) 671-1990 (916) 812-0005 (cellular) brad.dougherty@tteci.com	Project Quality Control Manager (PQCM)
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Tetra Tech EC, Inc.	To Be Determined	Site Health and Safety Specialist (SHSS)
Tetra Tech EC, Inc. 1940 E. Deere Ave, Suite 200 Santa Ana, CA 92705-5718	Ms. Lisa Bienkowski (949) 756-7592 lisa.bienkowski@tteci.com	Program Chemist
New World Technology, Inc. Hunters Point Shipyard 270 Nimitz Ave. (Bldg. 270) San Francisco, CA 94124	Mr. John Polyak (415) 216-2732 (412) 498-8477 (cellular) jrpolyak@juno.com	Radiation Task Manager (RTM)

The project personnel with the primary responsibilities for the achievement and verification of the project's radiological goals and objectives are the PjMs, CIH, QCM, Construction Manager, PQCM, CHP, RSO, SHSS, RTMs and Supervisors, Radiological On-site Laboratory Supervisors, Radiological Control Technicians (RCTs), and quality control (QC) representatives. Their roles and responsibilities are described in the following sections. DON oversight of the activities performed by the project team will be provided by the Radiological Affairs Support Office (RASO), BRAC PMO, and NFECSW personnel.

3.2.1 Project Manager

The PjM has the responsibility for directing, executing, and successfully completing project tasks to achieve overall project goals as well as the primary responsibility for coordinating activities and concerns with Navy RPMs and the RASO. The PjM also has the responsibility and authority to perform the following:

- Coordinating work activities of subcontractors and TtEC personnel and ensuring that all personnel adhere to the administrative and technical requirements of the project
- Monitoring and reporting the progress of work and ensuring that project deliverables are completed on time and within budget
- Ensuring adherence to the requirements of the contract, project scope of work, and project plans
- Ensuring that all work activities are conducted in a safe manner in accordance with the Site Health and Safety Plan (SHSP)
- Attending required meetings, including the pre-construction conference, weekly QC meetings, pre- and post-construction site inspections, and other scheduled and unscheduled meetings
- Serving as the senior contact between the DON and TtEC for actions and information related to the work
- Ensuring effective implementation of the radiological record management program
- Ensuring that all personnel assigned to perform field work are appropriately monitored for exposure to ionization radiation
- Coordinating regulatory site visits

3.2.2 Certified Industrial Hygienist

The CIH has authority to implement and oversee the TtEC Health and Safety Program. The CIH has the responsibility and authority to perform the following:

- Ensuring that all staff, including subcontractors, comply with the SHSP, state and federal regulations, and corporate policies

- Interacting with the PjM on all aspects of health and safety from the initial planning phase through fieldwork and closeout
- Providing advice and assistance on any safety, industrial hygiene, or accident prevention issue to the SHSS, PjM, and Construction Manager
- Reviewing all site health and safety documents and cost estimates, and working to properly staff projects
- Working to pre-qualify field subcontractors

3.2.3 Quality Control Program Manager

The QCM will report directly to the Corporate QC Manager and has the responsibility and authority to perform the following:

- Establishing and maintaining the QC program for the project
- Overseeing the QC program including data acquisition
- Working directly with the PjM and NFECSW QAO to ensure implementation of the Program QC Plan
- Acting as a focal point for coordination of all QC project-related matters and resolving all QC issues
- Providing QC direction and training to the PQCM and others performing QC functions
- Suspending project activities if quality standards are not maintained
- Interfacing with the DON, including the NFECSW QAO, on quality-related items
- Conducting field QC audits to ensure that site QC plans are being followed
- Performing reviews of audit and surveillance reports conducted by others
- Implementing DON technical direction letters related to QC topics

3.2.4 Construction Manager

The Construction Manager will report to the PjM and is responsible for coordinating, directing, implementing, and supervising site construction and support activities. The Construction Manager has the responsibility and authority to perform the following:

- Implementing field activities in accordance with the Base-wide Plan and TSPs
- Scheduling and directing field activities, support personnel, and subcontractors
- Administering site access and communication within active work areas
- Maintaining work site, facilities, vehicles, and equipment
- Ensuring that all work activities in the field are conducted in a safe manner in accordance with health and safety plans

- Coordinating and maintaining logistics of components of on-site tasks, including personnel and equipment
- Attending required meetings, including the pre-construction conference, weekly QC meetings, pre- and post-construction site inspections, and other scheduled and unscheduled meetings
- Preparing status reports and estimating future scheduling needs
- Preparing Daily Contractor Production Reports

3.2.5 Project Quality Control Manager

The PQCM is responsible for overall management of project QC and will report to the QCM. The PQCM or an alternate PQCM will be on site at all times during field activities. The PQCM has the responsibility and authority to perform the following:

- Monitoring activities to ensure conformance with the Base-wide Plan and that policies, procedures, contract specifications, and sound practices are followed
- Preparing the Daily QC Reports
- Ensuring that the three phases of inspection (preparatory, initial, and follow-up) are implemented for all definable features of work (DFWs)
- Ensuring that required tests and inspections are performed and the results reported
- Attending required meetings, including the pre-construction conference, weekly QC meetings, pre- and post-construction site inspections, and other scheduled and unscheduled meetings
- Processing, issuing, and maintaining Field Change Requests (FCRs) and Nonconformance Reports (NCRs) for project activities (construction- and radiological-related)
- Maintaining an NCR and FCR log
- Ensuring that planning documents are current and controlled
- Maintaining the Submittal Register and a Submittal Log
- Stopping work that is not in compliance with the contract

3.2.6 Certified Health Physicist

The CHP is responsible for implementing, directing, and supervising all radiological project-related activities. The CHP has the responsibility and authority to perform the following:

- Assisting in the development and approval of the SHSP
- Assisting in identifying radiological analysis needs
- Providing technical support in subcontractor selection

- Providing health physics guidance on an as-needed basis
- Providing radiological control protection services, if required
- Directing and assisting project personnel in proper completion of radiological records
- Assisting the RSO to determine if an external dose is to be assigned to an individual who reported lost or damaged dosimetry devices
- Ensuring that the required radiological safety training is provided to project personnel
- Reviewing and approving project field procedures that involve the handling of radioactive materials or access to radiological areas
- Ensuring timely and thorough review of records, in accordance with the Radiological Records SOP, prior to approval
- Approving records with verifiable signature and date once records meet the quality standards as described in the Radiological Records SOP
- Conducting radiation incident investigations
- Conducting radiological project inspections
- Conducting data assessment.

3.2.7 Radiation Safety Officer

The RSO will be responsible for oversight of the inspection and certification activities for radiological safety-related activities. The duties specified for the RSO may be shared with the CHP as appropriate. In accordance with DON requirements, the RSO or a qualified designee will be on site during radiological work conducted under this Base-wide Plan. The RSO has the responsibility and authority to perform the following:

- Providing radiological material-related safety briefings
- Assuring that specified radiological safety procedures are followed and that the radiological safety tests and inspections are complete and acceptable
- Conducting daily oversight and field safety inspections and tests required by the project technical specifications and applicable professional standards
- Attending required meetings, including the pre-construction conference, weekly QC meetings, pre- and post-construction site inspections, and other scheduled and unscheduled meetings
- Serving as a contact person for lost or damaged dosimeters for TtEC staff
- Conducting search of, investigating, and then documenting dosimeters reported lost or damaged for TtEC staff
- Ensuring that an individual who reported a lost or damaged dosimeter is excluded from a radiologically controlled area until the investigation is completed, documented, and the dosimetry device re-issued for TtEC staff

- Reviewing the exposure condition of an individual who reported lost or damaged dosimetry in order to assign an external dose with concurrence of the CHP
- Ensuring that each individual working at an impacted area wears a dosimetry device specified in the RWP
- Verifying compliance with on-site RWPs and SOPs (including laboratory SOPs)
- Assuring that all radiological safety documentation is provided to the PQCM for inclusion in the project files
- Reviewing all changes to the Sampling and Analysis Plan to ensure radiological requirements are met
- Approving issuance of any work document pertaining to radiological safety issues
- Providing surveillance of radiological-related activities
- Serving as a contact person for NRC site inspections
- Directing the production of radiological work documents and reports
- Stopping work that is not in compliance with RWPs, good radiological practices, and SOPs

3.2.8 Site Health and Safety Specialist

The SHSS ensures that all elements of the approved SHSPs are implemented and enforced on site. The SHSS will report directly to the CIH and will assist in implementing and enforcing the SHSP in the field. The SHSS has full authority to issue stop work orders or evacuation orders where work operations or noncompliance(s) may threaten the health and safety of site workers or the public. The SHSS has the responsibility and authority to perform the following:

- Ensuring that all personnel understand the requirements of TtEC's Environmental Health and Safety (EHS) program and procedures through training and communication
- Ensuring enforcement of SHSPs by means of daily site inspections
- Investigating all accidents, injuries, illnesses, near-misses, and other incidents
- Ensuring that project personnel are trained on the hazards of hazardous substances on the project, maintaining the Material Safety Data Sheet (MSDS) file to provide easy access to project personnel, and performing inspections to ensure that all waste containers are correctly labeled
- Developing necessary Building Health and Safety Plans (BHASP) as directed by the CIH and PjM
- Ensuring that the Base-wide Health and Safety Plan, BHASP, and SHSP are read, understood, and signed by all appropriate personnel including subcontractors
- Ensuring that tailgate safety meetings are conducted on days that work is performed and that documentation of all meetings and any other additional training is completed

- Verifying that project safety equipment is inspected, as required by the EHS program
- Coordinating site health and safety requirements with the Construction Manager and PjM
- Ensuring maintenance of all health and safety monitoring and personal protective equipment and directing site-monitoring activities
- Coordinating daily field activities with the Construction Manager
- Coordinating site safety and emergency response duties; verifying site communications system with site personnel
- Performing inspection of safety equipment
- Reporting to the ROICC within 2 hours all incidents required to be reported by Engineer Manual (EM) 385-1-1; and immediately reporting to the ROICC any fatal injury, one or more persons admitted to a hospital, or property damage to government property
- Verifying that all personnel have the necessary training and medical clearance prior to entering the exclusion zone or contamination reduction zone at the site; informing the Construction Manager of any site personnel with medical restrictions
- Determining and posting routes to medical facilities and emergency telephone numbers arranging for emergency transportation to medical facilities
- Serving as the Project Hazard Communication Coordinator
- Maintaining training records and medical certifications for all on-site personnel including subcontractors
- Initiating necessary revisions or changes to the SHSP
- Maintaining site control procedures
- Maintaining current records of certification for first aid and cardiopulmonary resuscitation (CPR) for project field personnel
- Attending required meetings, including the pre-construction conference, weekly QC meetings, pre- and post-construction site inspections, and other scheduled and unscheduled meetings

3.2.9 Radiological Task Manager

The RTM will direct and coordinate radiological activities ensuring that Nuclear Regulatory license requirements are met and that the requirements, goals, and objectives of the project are accomplished. The RTM has the responsibility and authority to perform the following:

- Reviewing project plans to determine scheduling and procedures for accomplishing project objectives
- Ensuring that the RTM or a similarly qualified designee will be on site during radiological activities

- Distributing and collecting dosimetry devices
- Performing dosimetry program reviews
- Determining accumulated external dose of workers, documenting dose in NRC Form 4 and providing a copy to each worker
- Determining requirements for work assignments including personnel monitoring devices
- Reviewing radiological work documents
- Determining and providing for radiological staffing for each phase of the project, and arranging for assignment of project personnel
- Conferring with project staff to outline work plan and to assign duties, responsibilities, and scope of authority
- Attending required meetings, including the pre-construction conference, weekly QC meetings, pre- and post-construction site inspections, and other scheduled and unscheduled meetings
- Reviewing reports prepared by project personnel and modifying schedules or plans as required
- Conferring with project personnel to provide technical advice and to resolve problems
- Preparing daily project status reports to be delivered to the PjMs, PQCM, and RSO
- Coordinating project activities with activities of regulatory or other governmental agencies, as directed by the PjM
- Notifying the PjM, RPM, and RASO regarding radioactive anomalies
- Managing the storage of radioactive waste in accordance with the radioactive material license
- Implementing and monitoring on-site radiological training programs

3.2.10 Program Chemist

The Program Chemist oversees sample collection, handling, analysis, and analytical data reporting. The Program Chemist has responsibility and authority for the following:

- Developing and maintaining the Sampling and Analysis Plan (Appendix B)
- Evaluating and selecting qualified subcontract laboratories
- Implementing data QC procedures and performing audit of field performance
- Reviewing off-site laboratory data prior to use
- Ensuring that proper review of non-radiological on-site laboratory data is performed
- Coordinating data validation of off-site laboratory data
- Reviewing data validation reports

- Preparing analytical reports and supports project report preparation
- Reviewing chemical hygiene plans

3.2.11 Radiological Task Supervisors

Radiological Task Supervisors (RTSs) will direct field survey personnel and health physics operations as assigned by the RTMs. The RTS has the responsibility and authority to perform the following:

- Performing the functions enumerated in the Base-wide RCP (TtFW, 2004a)
- Supervising field staff for survey, site remediation and decontamination, use of survey equipment and instrumentation, and support of programs and projects
- Ensuring compliance by RCTs with the applicable SOPs for safety program, survey, and/or remediation actions
- Ensuring compliance with NRC, Occupational Safety and Health Administration (OSHA), and EPA directives, as well as applicable local, state, and federal statutes and codes
- Interpreting and verifying data accumulated from surveys and monitoring activities
- Maintaining inventory and ensuring safe use and serviceability of tools, equipment, and vehicles on site
- Ensuring compliance with TSPs, as directed by the RTM and RSO
- Informing the RTM of work progress
- Ensuring that each individual working at an impacted area complies with the requirements specified in the RWP

3.2.12 Radiological On-site Laboratory Supervisor

The Radiological On-site Laboratory Supervisor will maintain oversight of the on-site laboratory program. The Radiological On-site Laboratory Supervisor has the responsibility and authority to perform the following:

- Maintaining laboratory equipment
- Running calibration checks (including control charts) and maintaining calibration data
- Maintaining chain of custody of on-site samples while in their possession; ensuring correct shipment of off-site confirmation samples
- Delivering raw analytical data to the RSO and Program Chemist, as directed
- Verifying on-site laboratory results with those obtained from the off-site laboratory
- Communicating analytical needs and capabilities

- Implementing the SOPs and laboratory quality assurance manual
- Providing training to staff regarding laboratory quality assurance policies
- Making recommendations for corrections and improvements as necessary
- Establishing and maintaining statistical limits for QC measurements

3.2.13 Radiological Control Technicians

The RCTs will support projects in the field and laboratory. The RCT has the responsibility and authority to perform the following:

- Conducting and documenting field surveys, sampling, and laboratory support in accordance with the Base-wide Plan, TSPs, and SOPs
- Interpreting and verifying field data accumulated from surveys and monitoring activities
- As assigned, assisting in training support personnel in health physics and safety
- Supporting dose assessments, and assuring compliance with QC programs, emergency plans, and procedures
- Performing effluent monitoring and radioactive material inventories
- Performing survey equipment efficiencies, response checks, and daily checks of the survey instruments
- Conducting safety evaluations of health physics field and laboratory equipment
- Preparing and implementing use of RWPs, including being present at active work areas to ensure compliance with the RWPs in the absence of the RTS

3.2.14 Radiological Support Personnel

Radiological support personnel are equipment operators and laborers performing field activities in support of survey activities under the direction of the Construction Manager. The equipment operators will maintain and operate heavy equipment. The laborers will support various field activities directed by the Construction Manager or his designee.

3.2.15 Remedial Project Manager

The RPM has primary responsibility within the DON for day-to-day management of the project activities performed under this Base-wide Plan and for their successful completion. The RPM's duties and authority include:

- Performing project management for the DON
- Ensuring that the project scope of work requirements are fulfilled
- Overseeing the project cost and schedule

- Providing formal technical direction to the TtEC project team, as needed
- Integrating CERCLA issues at HPS with ongoing radiological activities
- Coordinating with RASO and RPMs of other projects being performed in radiologically impacted areas to ensure proper controls are in place
- Acting as lead interface with agencies on non-radiological issues
- Together with the Radiological Site Manager, negotiating radiological release criteria with regulatory agencies

3.2.16 Radiological Site Manager

As a representative of the RASO, the Radiological Site Manager has primary responsibility within the DON for the technical accuracy and the regulatory conformance of work performed under this Base-wide Plan. The Radiological Site Manager oversees all radiological work at the HPS. The Radiological Site Manager's duties and authority include:

- Reviewing and approving project work plans and procedures
- Acting as lead interface with regulatory agencies on radiological survey plans and reports
- Together with the RPM, negotiating radiological release criteria with regulatory agencies
- Reviewing and approving on-site laboratory analytical data
- Reviewing and approving project reports
- Ensuring compliance with applicable MARSSIM requirements
- Recommending changes in TtEC scope to the RPM, as appropriate
- Supporting regulatory and public meetings

3.2.17 Quality Assurance Officer

The QAO is the DON representative with the primary responsibility for ensuring that contract-required quality assurance measures are in place and effective for the work performed under this Base-wide Plan. The QAO's duties and authority include:

- Reviewing and approving Sampling and Analysis Plans
- Providing DON oversight of the TtEC Quality Assurance Program
- Providing quality-related directives through the Contracting Officer Representative
- Providing technical and administrative oversight of TtEC surveillance audit activities
- Acting as point of contact for matters concerning quality assurance and the DON's Laboratory Quality Assurance Program

- Coordinating training on matters pertaining to generation and maintenance of quality of data
- Authorizing the suspension of project execution if quality assurance requirements are not adequately followed

3.2.18 Resident Officer in Charge of Construction

The ROICC staff have the primary responsibility for providing on-site quality assurance and safety oversight of contractors performing work at HPS. The ROICC staff duties and authority include:

- Verifying that all work has been completed per contract and technical specifications prior to final government acceptance
- Performing ongoing field inspections to verify that all work is in compliance with both contract and technical specifications
- Notifying the contractor of any work that is not in compliance
- Interacting with the contractor's PQCM on quality-related issues
- Reviewing and signing waste manifests for non-radiological wastes as the generator's representative
- Reviewing contractor daily reports for completeness and accuracy
- Attending Preparatory Phase, Initial Phase, Pre-final, and Final Acceptance Inspections
- Attending weekly QC meetings

3.3 TRAINING

The minimum training requirements for all personnel working in the field include the following:

- OSHA 40-Hour and Annual 8-Hour Refresher
- Radiation awareness training
- RWP and TSP training for the specific site or task
- Activity Hazard Analysis (AHA) training for the specific site or task
- BHASP or SHSP training, as required by the plans

3.4 WORK CONTROL PROCEDURES

Prerequisites for the initiation of survey activities include completion of a TSP, BHASP and SHSP, required notifications, as well as the procurement of services, equipment, and materials necessary to perform the work. Additional activities will include a pre-work radiological evaluation of the designated work areas.

3.4.1 Task-specific Plan

The Base-wide Plan is intended to provide the requirements and conditions applicable throughout the course of the project. Implementing the work plan necessitates the development of a TSP for each building, area, or activity. Each TSP will include the following information as applicable to the task:

- Task description, including the specific location history, purpose of the task, and the isotopes of concern
- Data quality objectives (DQOs) defined to a level sufficient to ensure that the data obtained will support the goals of the task
- An activities plan consisting of a survey description and discussion of additional activities necessary to support the survey, which will include a description of applicable specific construction or decontamination and decommissioning (D&D) activities (as required)
- Specific identification of variations, if any, to the Base-wide Plan, including the work plan requirement, the required variations, and the technical justification for the variations
- Specific survey figures (as required) that provide sampling and survey data points and other figures necessary to support the activity
- Attachments (as necessary) to provide further description, information or delineation of the task activities

Each TSP will be provided to the DON (RPM and RASO) for review and approval.

3.4.2 Radiological Health and Safety

SOPs will be used to address controls necessary for radiologically safe operations and referenced as necessary in appropriate TSPs. Critical requirements resulting from the aforementioned documents include the presence at active work locations of an SHSS to ensure implementation of the SHSP or BHASP as well as, an RCT to ensure compliance with the RWP. Dose rate, contamination, and air monitoring, including initial baseline sampling to determine radiological background conditions, will be performed as necessary. Personnel protective equipment (PPE) levels, dictated by radiological considerations and physical and chemical safety issues identified at each work location, will be assigned or modified, according to the approved RWP and BHASP.

3.4.3 Radiation Work Permits

An RWP will be prepared that will specify the activities to be performed and include radiological safety requirements for the work. All personnel assigned to site work will be required to understand the requirements and sign the RWP prior to beginning work. RWPs will be used to

identify the requirements for entering, exiting, and conducting work in radiologically impacted areas identified in the HRA. An example of an RWP is presented in Appendix A.

3.4.3.1 Purpose of the Radiation Work Permit

RWPs provide guidelines specifying the appropriate personnel protective measures within the scope of the work based upon the radiological conditions in the area. The RWP will also provide a complete document addressing existing radiological conditions, work scope and limitations, radiological limitations, PPE requirements, dosimetry requirements, ALARA considerations, and specific instructions to personnel. An RWP should not be used unless a radiological survey has been performed in the work area within the last 24 hours or there is reasonable assurance that radiological conditions have not changed as determined by the RTM or his/her designee. Changes to an RWP will be noted during the daily safety briefing. The absence of any changes will also be communicated during the briefing.

3.4.3.2 Development of the Radiation Work Permit

The RTM, or qualified designee, will perform or assign an RCT to perform an assessment of the work area. Prior to performing a work area survey, the RCT will be as knowledgeable as possible about the nature of the work to be performed (surface or sub-surface surveying, drilling, sample collection, equipment repair, decontamination, jack hammering, and so forth). In addition, consideration will be given to the specific component or equipment to be worked on, the positions the workers may take to perform the work (i.e., kneeling on the ground, leaning against one component to work on another), and the possibility of the presence of radioactive debris.

All assessments will clearly identify the radiological hazards present in the work area. The following guidelines will be considered when performing a work area assessment:

- What are the contamination, radiation, and airborne radioactivity levels at the position(s) where the individual is to work?
- Where are the designated radiation and/or contaminated area boundaries?
- Are there special radiological hazards or hot spots?
- If work on a specific component is required, what are the contact and 30 centimeter (cm) dose rates for the component?
- Is there or could there be material and equipment present?
- What additional safety hazards may be encountered at the job site?

Upon completion of the assessment, the RCT will complete a draft of the RWP, entering all existing radiological conditions, source of survey information, and the RWP number.

3.4.3.3 Review and Approval of the Radiation Work Permit

The RTM or a designee will review the RWP for accuracy and correctness. A copy of the draft RWP will also be provided to the SHSS for review. Upon completion of their respective reviews, the RTM, or designee, and SHSS will discuss the draft RWP. After ensuring that the RWP is complete and addresses relevant non-radiological safety considerations identified by the SHSS, the RTM, or qualified designee, will approve the RWP. The RTM will then submit the RWP to the RSO for review and approval.

3.4.3.4 Implementation of the Radiation Work Permit

Before beginning work governed by the RWP, the RTM or a designee will conduct a pre-job briefing with the work crew. Pre-job briefings will be documented. The RTM or a designee will answer questions resulting from RWP reviews. Prior to working under an RWP, the user will sign the RWP indicating that he/she understands the requirements of the RWP. A copy of the RWP will be kept at the work location.

3.4.3.5 Changes to the Radiation Work Permit

In the event of changes to conditions or scope of work that do not justify the generation of a new RWP, two modifications of the RWP may be made by the RTM with the concurrence of the RSO. Revisions to the RWP will be performed in accordance with the approved SOP. Upon completion of the modification or extension of the RWP, the RTM will communicate all changes made to the RWP to the affected work crew and work crew supervisors prior to the commencement of work covered under the revised RWP. Upon termination of an RWP, the original RWP will be retained in the project file.

3.4.4 Notifications

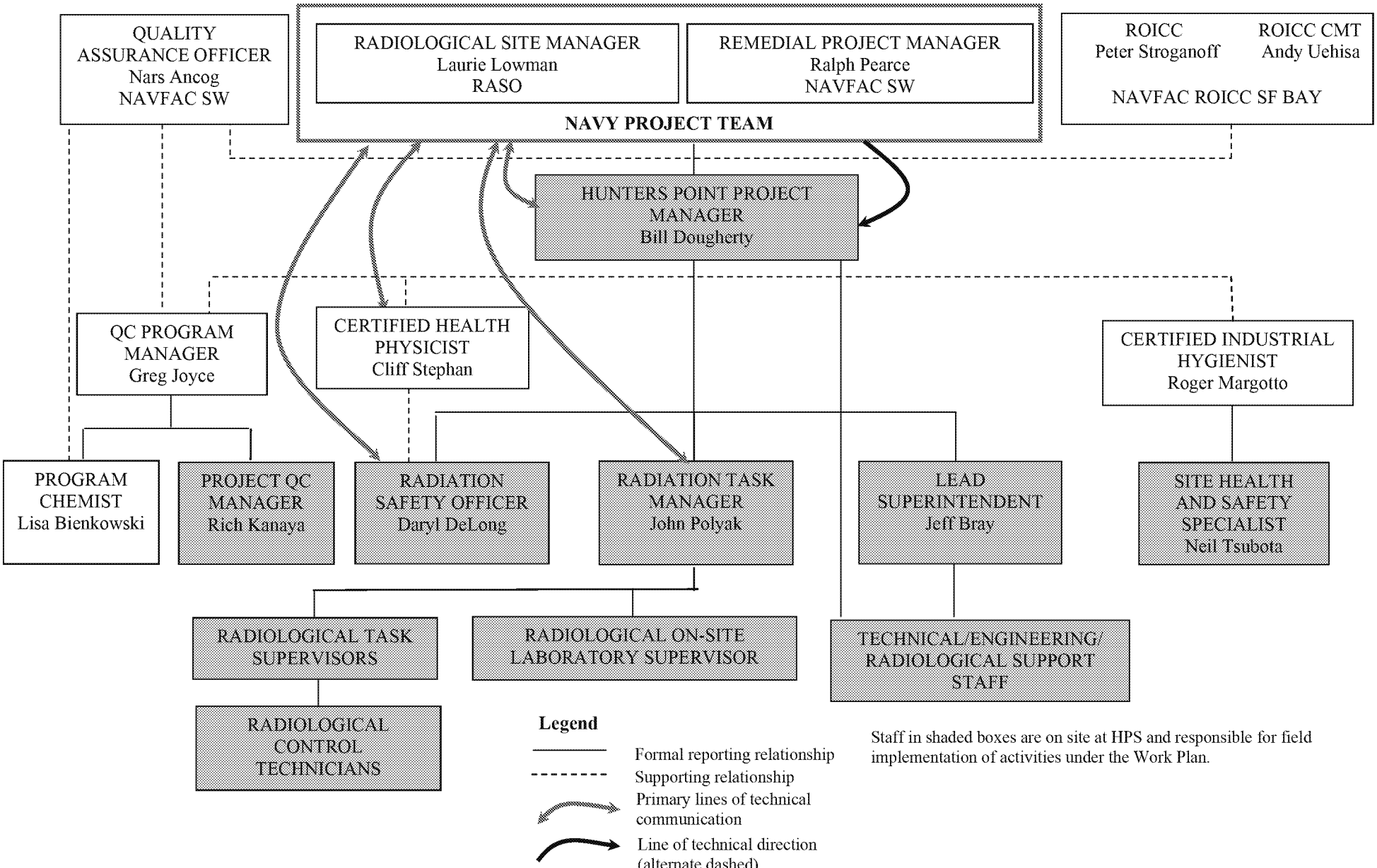
During survey activities, radioactive anomalies could be identified and significant events could occur. An anomaly, for purposes of this plan, is described as a reading or result that appears to be an outlier in the professional judgment of the RTM. When an anomaly is identified, the RTM will notify the RSO, PjM, RPM, and the Radiological Site Manager. If neither person is available, the RTM will leave a voice mail and confirmatory e-mail describing the anomaly and follow up with a call to the appointed designee, if any.

Significant events include regulatory visits (such as by the NRC or other regulatory agencies), radiological issues, injuries, and breaches in security. All significant events will be disclosed to the RPM and RASO as described above. Any radiological issues will also be reported to the RSO.

Non-regulatory third-party individuals, including members of the media, requesting access to the site or asking questions will be referred to the RPM. TtEC personnel or their subcontractor will not grant site access or answer questions for unauthorized personnel. The PjM will notify the RPM and RASO of any attempts to gain site access.

FIGURE 3-1

PROJECT ORGANIZATION CHART



Project Work Plan
Base-wide Storm Drain and Sanitary Sewer Removal
Hunters Point Shipyard
DCN: FWSD-RAC-05-0165.R1
CTO No. 0006, Revision 1, 10/5/2007

4.0 RADIOLOGICAL SURVEY TYPES, AREA CLASSIFICATION, AND SELECTION

Several types of radiological surveys will be conducted at HPS. Surveys will be used to support the release of materials, equipment, open areas, utilities and/or buildings; support remedial actions; identify radionuclides and levels of contamination present; and support unforeseen work that may be necessary.

4.1 SURVEY TYPES

Listed below are the types of surveys that may be performed.

4.1.1 Reference (Background) Area Survey

The reference area is where the background radioactivity is measured and defined for comparison to field survey/sample data collected during surveys.

The reference area is a geographical area or structure from which representative radioactivity measurements are performed for comparison with measurements performed in an impacted area. The reference area is an area that should have similar physical, chemical, radiological, and biological characteristics as the impacted area(s) being investigated, but that has not been identified as impacted by the HRA. All on-site and off-site areas selected as reference will be approved by the Radiological Site Manager. The same survey methods and equipment that will be used for conducting a survey in an impacted area will be used for the background area survey. Reference area data will normally be provided to the RSO prior to the start of a survey.

4.1.2 Scoping Survey

Scoping surveys provide site-specific information based on limited measurements. Scoping surveys are to be conducted as indicated by the HRA (with guidance from MARSSIM) and will consist of judgment measurements based on the HRA data and professional experience. Sufficient information will be collected to identify situations that require immediate radiological attention or to support development of other project activities.

The primary objectives of scoping surveys are to:

- Perform a preliminary contamination assessment
- Identify radionuclide contaminants
- Assess radionuclide ratios
- Assess general levels and extent of radionuclide contamination

- Support classification of impacted areas
- Evaluate whether the survey strategy can be optimized for use in the characterization or FSSs

4.1.3 Characterization Survey

The characterization survey is the most comprehensive of the survey types and generates the most data. This includes preparing a reference grid, systematic as well as judgment measurements, and surveys of different media (e.g., surface soils, interior and exterior surfaces of buildings). The decision as to which media will be surveyed is a site-specific decision addressed throughout this Base-wide Plan and each TSP.

Characterization surveys are planned based on the HRA, MARSSIM guidance, and/or scoping survey results. The primary objectives of characterization surveys are to:

- Assess the nature and extent of the contamination, if present
- Collect data to support evaluation of remedial alternatives and technologies
- Evaluate whether the survey strategy can be optimized for use in the FSS
- Provide input to the FSS design

4.1.4 Remedial Action Support Survey

Remedial action support surveys are performed to assess the effectiveness of the remedial action while remediation is being conducted, and to guide the cleanup in a real-time mode. The primary objectives of remedial action support surveys are to:

- Support remediation activities
- Assess when an area is ready for the FSS
- Provide site-specific information used for planning the FSS

4.1.5 Final Status Survey

The FSS provides data to demonstrate that radiological parameters satisfy the established guideline values and conditions for radiological release. Data from other surveys conducted during the course of site investigations at HPS—such as scoping, characterization, and remedial action support surveys—can provide valuable information for planning an FSS. The primary objectives of FSSs are to:

- Verify classification
- Demonstrate that the potential dose or risk from residual contamination is below the release criteria

- Demonstrate that the potential dose or risk from small areas of elevated activity is below the release criteria

4.1.6 Personnel Surveys

Personnel surveys are used to ensure that individuals leaving a radiological area are free of contamination.

4.1.7 Equipment and Materials Surveys

Before being put into service or leaving a radiological work area, equipment and/or materials will be surveyed in an area of low background concentrations to ensure that the equipment and materials release criteria are not exceeded, using appropriate SOPs.

- Equipment and/or materials being put into service in a radiological work area at HPS that exceed the release criteria will be returned to the supplier for replacement or decontamination.
- Outgoing equipment and/or materials that do not meet the release criteria will be decontaminated before leaving the radiological work area or stored for disposal.

4.1.8 Truck Surveys

Surveys will be performed on vehicles leaving and arriving at HPS that are loaded with non-contaminated material as a measure to protect against the inadvertent shipment or receipt of materials exhibiting elevated radiation levels. Surveys will be accomplished using a portal monitor with specifications similar to those used at disposal facilities, or manually surveyed using portable survey equipment, and will be operated using established SOPs.

4.2 SURVEY AREA CLASSIFICATION

The HRA has identified areas at HPS that have been classified as impacted. Based on available information from previous surveys and the HRA, each area will be given a classification. Impacted areas are divided into one of three classifications as described below.

4.2.1 Class 1 Areas

Class 1 areas have, or had prior to remediation, a potential for radioactive contamination (based on site operating history) or known contamination (based on previous radiation surveys) above the derived concentration guideline level ($DCGL_W$). Examples of Class 1 areas include:

- Site areas previously subjected to remedial actions
- Locations where leaks or spills are known to have occurred
- Former burial or disposal sites

- Waste storage sites
- Areas designated as such in the HRA

4.2.2 Class 2 Areas

Class 2 areas have, or had prior to remediation, a potential for radioactive contamination or known contamination, but are not expected to exceed the $DCGL_W$. Examples of areas that might be classified as Class 2 for the FSS include:

- Locations where radioactive materials were present in an unsealed form
- Potentially contaminated transport routes
- Areas downwind from stack release points
- Upper walls and ceilings of buildings or rooms subjected to airborne radioactivity
- Areas handling low concentrations of radioactive materials
- Areas designated as such in the HRA
- Buffer areas on the perimeter of Class 1 areas

4.2.3 Class 3 Areas

Class 3 areas are not expected to contain residual radioactivity, or are expected to contain levels of residual radioactivity at a small fraction of the $DCGL_W$, based on site operating history and previous radiation surveys. Examples of areas that might be classified as Class 3 include:

- Buffer zones around Class 1 or Class 2 areas
- Areas with very low potential for residual contamination but insufficient information to justify a non-impacted classification
- Areas designated as such in the HRA

4.3 CLASSIFICATION AND SURVEY UNIT SIZE

A survey unit is a physical area consisting of structures or land areas of specified size and shape for which a separate decision will be made as to whether or not that area exceeds the release criteria. This decision is made as a result of the FSS. As a result, the survey unit is the primary entity for demonstrating compliance with the release criteria.

Survey units will be limited in size based on classification, exposure pathway modeling assumptions, and site-specific conditions. The limitation on survey unit size for Class 1 and Class 2 areas ensures that each area is assigned an adequate number of data points. Table 4-1 lists the survey unit sizes.

4.4 REFERENCE COORDINATE SYSTEMS

A reference coordinate system will be laid out for each survey unit to identify survey/sample locations. Two different grid systems, as specified in MARSSIM, may be used. The specific TSP will specify the grid system to be used.

4.4.1 Square Grid

A square grid system may be used for Class 1 and Class 2 survey units. For Class 3 survey units a square grid system can be used, if specified in the TSP. The length, L, of a side of the square grid is determined by the total number of samples or measurements to be taken. The length of the square will determine the distance between survey data points. The length or spacing of the grids will be calculated for each of the survey units using the following equation:

Equation 4-1

$$L = \sqrt{\frac{A}{N}}$$

Where:

L = length of spacing (meters [m])
A = surface area of the survey unit (square meters [m^2])
N = number of data points

Grid locations are then positioned throughout the survey unit by first randomly selecting a start point and establishing a systematic pattern. Random numbers for the square grid method, between zero and one, are determined for both the X and Y locations in each survey unit. The random number is then multiplied by the L (length of square grids) to determine both the starting X and Y locations in each survey unit. The length L is then used to determine all remaining data points based on this starting location.

4.4.2 Triangular Grid

A triangular grid system may be used for Class 1 and Class 2 survey units, but will not normally be used in Class 3 survey units. The length in between triangular grid data points (L) is determined by the total number of samples or measurements to be taken, using the following equation.

Equation 4-2

$$L = \sqrt{\frac{A}{0.866 * N}}$$

Where:

L	=	length of spacing (meters [m])
A	=	surface area of the survey unit (square meters [m^2])
0.866	=	constant factor from MARSSIM
N	=	number of data points

A second row of points is then developed, parallel to the first row, at a distance of 0.866 x L from the first row. Survey points along that second row are midway (on the X-axis) between the points on the first row. This process is repeated to identify a pattern of survey locations throughout the survey unit. If identified points fall outside the survey unit or at a location that cannot be surveyed, additional points are determined using the random process described above, until the desired total number of points is identified.

The triangular grid system is generally more efficient for locating small areas of elevated activity. A more detailed discussion is provided in *Statistical Methods for Evaluating the Attainment of Cleanup Standards, Volume 3: Reference Based Standards for Soils and Solid Media* (EPA, 1994).

4.5 SURVEY TYPE SELECTION

The type of survey selected for an area or survey unit will be specified by either the recommendations contained in the HRA or discussions and technical direction from RASO. The exception will be remedial action support surveys, personnel surveys, equipment and material surveys, and truck surveys, which will be used as necessary to assess the effectiveness of decontamination activities and to release personnel, equipment, and material.

The survey progression is reassessed typically when a survey unit fails to meet the release criteria during an FSS effort. If a Class 2 or 3 survey unit fails to meet the criteria for release, it would undergo decontamination or remedial actions, where necessary, and be reclassified as a Class 1 unit for the follow-up survey actions. If a Class 1 survey unit fails to meet the release criteria, decontamination and remedial action support surveys will be performed. A Class 1 survey will follow decontamination or remedial activities.

TABLE 4-1

SURVEY UNIT SIZE

Area Classification	Survey Unit Size
Class 1 Structure	up to 100 m^2 floor area
Class 1 Land area	up to 2,000 m^2
Class 2 Structure	100 to 1,000 m^2
Class 2 Land area	2,000 to 10,000 m^2
Class 3 Structure	No Limit
Class 3 Land area	No Limit

Notes:

m^2 – square $meter^2$

5.0 SURVEY OVERVIEW

This section provides an overview of survey planning, implementation, and data assessment. Survey details are given in later sections of this plan. Additional specific details will be provided in future TSPs.

5.1 DATA LIFE CYCLE

Compliance demonstration is simply a decision as to whether or not a survey unit meets the release criterion. This decision is based on the results of one or more surveys. Positive actions must be taken to manage the uncertainty in the survey results so that sound, defensible decisions may be made. These actions include proper survey planning to control known causes of uncertainty, proper application of QC procedures during implementation of the survey plan to detect and control significant sources of error, and careful analysis of uncertainty before the data are used to support decision making. These actions describe the flow of data throughout each type of survey, referred to as the Data Life Cycle.

There are four phases of the Data Life Cycle:

- *Planning Phase.* The survey design is developed and documented using the DQO process, which is presented in detail in Section 5.2.3.
- *Implementation Phase.* The survey design is carried out in accordance with the TSPs resulting in the generation of raw data. Additionally, quality assurance and QC measurements will generate data and other important information that will be used during the Assessment Phase.
- *Assessment Phase.* The data generated during the Implementation Phase are first verified to ensure that the TSPs were actually followed and that the measurement systems were performed in accordance with the criteria specified in this plan. Then the data are validated to ensure that the results of data collection activities support the objectives of the survey, as documented in the applicable TSP, or permit a determination that these objectives should be modified.
- *Decision-making Phase.* A decision is made, in coordination with the responsible regulatory agency, based on the conclusions drawn from the assessment process. The ultimate objective is to make technically defensible decisions with a specified level of confidence.

5.2 SURVEY PLANNING

The Radiation Survey and Site Investigation (RSSI) process includes a series of surveys that will be used at HPS to demonstrate compliance with the release criterion. This process will be used as a framework for collecting the information required for scoping, characterization, remediation, and

FSS activities. The DQO methodology discussed below will be used at HPS to implement the RSSI process. This process consists of the following six principal steps:

- Site identification
- Historical site assessment
- Scoping survey
- Characterization survey
- Remedial action support survey
- FSS

Table 5-1 provides a simplified overview of the principal steps in the RSSI process and how the Data Life Cycle can be used in an iterative fashion within the process.

Figure 2.4 of MARSSIM illustrates the RSSI process in terms of area classification and lists the major decision to be made for each type of survey. The flow chart, illustrated in Figures 2.5 through 2.8 of MARSSIM, presents the principal steps and decisions in the site investigation process and shows the relationship of the survey types to the overall assessment process.

5.2.1 Survey Design Elements

Survey and sampling process design includes, but is not limited to, the following elements:

- The *types of samples and sampling matrices* for the survey; solid samples for outdoor surveys, and fixed measurements for indoor surveys
- The *measurement frequency* for direct measurement locations for each survey unit and scan percentage of each survey unit
- The *sampling frequency* for solid sample collection locations in the survey unit(s)
- The *methods* for performing remedial action support surveys and other ancillary surveys

However, before these elements can be established, a general strategy must be determined.

5.2.2 SURVEY STRATEGY

Strategies for implementing the various survey types at HPS are provided in Table 5-2. The selection of specific survey types for each area investigated under the Base-wide Plan will be based on information given in the HRA (NAVSEA, 2004) and will be identified in each area's corresponding TSP. For an FSS, the standard survey strategy will be based on using a MARSSIM Scenario A approach, as described in Sections 5.2.3.5 and 5.5.3. On a case-by-case basis, as identified in a TSP, the FSS design using the Scenario B approach would be considered.

5.2.3 Data Quality Objectives

MARSSIM recommends using the seven-step DQO process in the design of radiological surveys. This process tailors the survey to the particular conditions around each survey situation. This section summarizes DQO elements applicable to most of the surveys to be performed under this plan. Specific DQOs for each survey will be established in the relevant TSPs.

5.2.3.1 State the Problem

The first step in the DQO process is to simply state the problem. The problem is, "Existing data are not sufficient to support release of the impacted areas at HPS."

- A scoping survey is needed to provide data to plan the release or remediation of a building or area.
- A characterization survey is needed to provide additional data to plan the release or remediation of a building or area.
- A remedial action support survey is needed to provide data while implementing the remediation of a building or area.
- An FSS is needed to provide data for free release of a building or area.

5.2.3.2 Identify the Decision

- For a scoping survey, the decision is, "Does the survey defined in the TSP identify the radionuclides of concern and assess general levels and extent of contamination?"
- For a characterization survey, the decision is, "Does the survey information defined in the TSPs identify the nature and extent of the contamination, which may lead to remediation?"
- For a remedial action support survey, the type of decision is, "Does the remedial action support survey indicate that the remediation is complete (as defined in the TSPs)?"
- For an FSS, the decision is, "Do the FSS results demonstrate compliance with the release criteria?"

5.2.3.3 Identify Inputs to the Decision

Inputs will vary, depending on the specific survey, and will be detailed in the TSP. However, in general, some or all of the following data will be used.

- Gamma scan survey
- Alpha/beta scan surveys
- Systematic and biased static alpha, beta (buildings and structures), and gamma static readings

- Systematic and biased solid and smear sampling
- Systematic and biased exposure rate measurements

For a scoping survey, additional inputs to the decision are the information in the HRA and the radiological survey data collected during the implementation phase.

For a characterization survey, additional inputs are again the information in the HRA and the radiological survey data collected during the implementation phase.

For a remedial action support survey, additional inputs are the results of prior surveys and the specific remediation plans.

For an FSS, additional inputs are the radiological survey results and the release criteria.

5.2.3.4 Define Study Boundaries

Study boundaries will depend on the particular survey performed. For a building or land area, it will be the physical boundaries of those spaces. For remedial action support surveys, it will be the extent of the remedial action work area and associated support areas. Study boundaries will be presented, on a case-by-case basis, in TSPs.

5.2.3.5 Develop a Decision Rule

For each applicable survey, developing a decision rule is as follows:

- For a scoping survey, the decision rule is, "If the survey results meet the criteria defined in the TSPs, then design and perform an optimized FSS. If the survey results do not meet the criteria defined in the TSPs, then design and perform an optimized characterization survey."
- For a characterization survey, the decision rule is, "If the survey results meet the criteria defined in the TSPs, then design and perform an optimized FSS. If the survey results do not meet the criteria defined in the TSPs, then perform remedial action."
- For a remedial action support survey, the decision rule is, "If the survey results indicate that the remediation is complete (as defined in the TSPs), then design and perform an optimized FSS. If the survey results indicate that the remediation is incomplete, then re-evaluate the remedial alternative and continue remediation if necessary."
- For an FSS, the decision rule is, "If the survey results demonstrate compliance with the release criteria, then document the results in the FSS report. If the survey results do not demonstrate compliance with the release criteria, then additional assessment and/or remediation are necessary."

The release criteria for buildings, structures, material, and land areas at HPS are listed in Section 6.0. Limits for a specific building, area, or for multiple radionuclides will be given in the TSPs.

In evaluating this decision, unless otherwise indicated in the TSP, MARSSIM Scenario A will be applied. In Scenario A, the null hypothesis (H_o) is tested to verify if the residual contamination exceeds the release criterion; also, the alternative hypothesis (H_a) is tested to determine if the residual contamination meets the release criterion. Details on the null hypothesis are given in Sections 5.2.3.6 and 5.5.3.

5.2.3.6 Set Limits on Decision Errors

For those surveys where decision errors would be used, there are two types of decision errors that can be made. The first type of decision error, called a Type I error, occurs when the null hypothesis is rejected when it is actually true. A Type I error is sometimes called a "false positive." The probability of a Type I error is usually denoted by alpha (α). The Type I error rate is often referred to as the significance level or size of the test.

The second type of decision error, called a Type II error, occurs when the null hypothesis is not rejected when it is actually false. A Type II error is sometimes called a "false negative." The probability of a Type II error is usually denoted by beta (β) . The *power* of a statistical test is defined as the probability of rejecting the null hypothesis when it is false. It is numerically equal to 1-β, where β is the Type II error rate.

Each survey will be designed to limit Type I and Type II errors to 5 percent. However, if additional samples have been determined as necessary once the data is analyzed, the Type I error will be reduced to 2.5 percent. It is important to minimize the chances of concluding that a survey unit meets the release limits (reject the null hypothesis) when it actually exceeds the limits (Type I Error), and of concluding that a survey unit exceeds the release limit (accept the null hypothesis) when it actually meets the limit (Type II Error).

5.2.3.7 Optimize Data Collection

Guidelines for optimizing the data collection process are presented below:

- Review Outputs and Existing Data for Consistency

  Radioactive source readings will be used to check instruments for consistency prior to use in each daily shift. The instrument will be used only after readings are compared and agree within +/- 20 percent of predetermined responses. The RTS (or designee) will review the information each day to verify that the equipment is operating satisfactorily.

The RTM, or qualified designee not involved in the direct data collection process will review the survey data on a daily basis. This will ensure an ongoing independent review for consistency of survey data collected.

- Develop Data Collection Design Alternatives

  MARSSIM guidelines will be used and a 95 percent confidence level for detecting radioactivity above the release criteria will be assumed with Type I and Type II errors limited to 5 percent.

- Document Operational Details and Theoretical Assumptions

  Operational details for the radiological survey process have been developed for and are included as part of this Base-wide Plan. The theoretical assumptions are based on guidelines contained in MARSSIM. Generic information regarding types of radiation measurements, instrument detection capabilities, selection of quantities and locations of data to be collected, investigation levels, and release criteria are contained in this Base-wide Plan and associated Sampling and Analysis Plan (SAP). Site-specific operational details and theoretical assumptions will be identified in relevant TSPs.

5.3 SURVEY IMPLEMENTATION

Survey implementation for each type of survey to be conducted at HPS is discussed below. While implementation requires instrumentation and survey techniques, this section will concentrate on the general approach. The instrumentation to be used is discussed in Section 7.0 and survey techniques are presented in Section 8.0 of this Base-wide Plan. Other survey specifics will be presented in the TSP.

5.3.1 Scoping and Characterization Surveys

These surveys will be implemented as described in their individual TSPs. In practice, scoping and characterization survey data that indicate that the residual activity is below the DCGL for the building/area will be used in the FSSs where possible.

5.3.2 Remedial Action Support Surveys

These surveys are implemented during the remedial activity. For example, surveys to support remediation would follow the decontamination work to assess progress.

5.3.3 Final Status Surveys

For the FSS, the data analysis framework is critical to survey development because it drives the sampling requirements. For contaminants present in background, the analysis uses the Wilcoxon

Rank Sum (WRS) test. For contaminants not present in background, the analysis uses the Sign test. In each case, the minimum number (N) of samples (or fixed measurements) is calculated as follows: the method to calculate any additional number of required data points is stated in Section 6.1, and grid spacing methods and requirements are listed in Section 4.4. The statistical tests are described in Section 5.4.

5.3.3.1 Determination of the Relative Shift

Using Equation 5-1, the value of the relative shift can be determined. For single radionuclide analysis, the values for the lower boundary of the gray region (LBGR) will be set at half the DCGL during the planning phase, and at the median concentration in a survey unit for the data assessment phase

When analyzing multiple radionuclides, the values for the LBGR and σ are determined using Section 6.2

Equation 5-1

$$\frac{\Delta}{\sigma} = \frac{DCGL_W - LBGR}{\sigma}$$

Where:

$DCGL_W$	=	$DCGL_W$ as appropriate
$LBGR$	=	Lower boundary of the Grey Region as appropriate
σ	=	Standard deviation from the survey unit, as appropriate

The value of the relative shift is used with the appropriate random measurement probability presented in MARSSIM, (Tables I.2a and I.2b).

5.3.3.2 Determination of the Number of Data Points

When the contaminant is present in background, Equation 5-2 is used with the WRS test:

Equation 5-2

$$N = \frac{\left(Z_{1-\alpha} + Z_{1-\beta}\right)^2}{3\left(P_r - 0.5\right)^2}(1.2)$$

When the contaminant is not present in background, Equation 5-3 is used with the Sign test:

Equation 5-3

$$N = \left(\frac{\left(Z_{1-\alpha} + Z_{1-\beta}\right)^2}{4(Sign\ p - 0.5)^2} \right)(1.2)$$

Where:

$Z_{1-\alpha}$ = Type I decision error level
$Z_{1-\beta}$ = Type II decision error level
P_r = random measurement probability
Sign p = random measurement probability
(1.2) = 20% increase in number of samples over the minimum

During the data assessment phase, the 20 percent increase of samples is omitted for statistical purposes.

5.3.4 Error Control

Actions to minimize errors will be instituted during the data collection phase of the surveys. Qualified radiation survey personnel will perform the survey and record the data. Automated recording of survey data will be used where possible to minimize errors. Data transcribing is an activity where errors may arise. To minimize data errors for manual surveys, experienced personnel will record and transcribe data.

Standard applicable quality assurance and quality control measures will be implemented to control error.

The ongoing on-site analyses and evaluation of survey results provide a verification check for errors, which, if detected, will be corrected.

A knowledgeable individual who is not involved in the direct data collection process (e.g., RTS) will review the survey data on a daily basis. This will ensure an ongoing independent review for consistency of survey data collected.

5.4 ASSESSMENT OF SURVEY RESULTS

A preliminary evaluation of the data set will be conducted to better understand the structure of the data and thereby identify appropriate approaches and limitations for utilization. For non-FSSs, this may be merely identifying areas of elevated contamination or reviewing the mean, median, and standard deviation of the data set. FSS activities to accomplish the evaluation include, but are not limited to, reviewing quality assurance reports, calculating statistical quantities, and graphing the data.

5.4.1 Scoping and Characterization Surveys

Basic statistical quantities (mean, maximum, standard deviation) will be calculated from the data collected. When a reference area is surveyed, the same quantities will be calculated. The focus of the data assessments will normally be the comparison of the survey data to the DCGL for the building/area. If all measurements are less than the DCGL, then the data will be used in the FSSs where possible. Measurements above the DCGL will be assessed for further action.

5.4.2 Remedial Action Support Surveys

The focus of these data assessments will also be the comparison of the survey data to the DCGL for the building/area. If all measurements are less than the DCGL, then the remedial action can be declared complete and a final status survey performed. Otherwise, measurements above the DCGL will be identified for continued remedial action.

5.4.3 Final Status Surveys

When determining compliance with FSS goals, the survey data are examined. Compliance tests are summarized as follows:

- Compare the largest measurement to the DCGL (net of background, if present in background).
- Compare the average measurement to the DCGL (net of background, if present in background).
- Use the appropriate statistical test to determine if the survey data exceed the release limits.
- If scan measurements are above the DCGL, then a fixed measurement will be taken to confirm the elevated reading. If the elevated reading is confirmed, then the unit would fail.

When multiple nuclides are present, each with an individual DCGL, they will be assessed in accordance with the methods given in Section 6.2.

This plan will use an analysis structure incorporating three possible common statistical procedures, as well as conventional qualitative and semi-quantitative comparisons for FSS data. The statistical tests are only applied to measurements made at fixed locations. The tests are:

- **Sign test** – The Sign test is a one-sample, non-parametric test that can be used to evaluate compliance with the release limit. The Sign test is the recommended compliance evaluation procedure when the contaminant(s) under evaluation are not present at significant levels in background. Any one of the individual samples (each individual survey unit is a "sample" in this context) or any combination can be compared to the release limit with the Sign test. For example, each of the Class 1

TABLE 5-1

THE DATA LIFE CYCLE USED TO SUPPORT THE RADIATION SURVEY AND SITE INVESTIGATION PROCESS

RSSI Process	Data Life Cycle	Phases	MARSSIM Guidance
Site Identification			Provides information on identifying potential radiation sites (Section 3.3)
Historical Site Assessment	Historical Site Assessment Data Life Cycle	Plan Implement Assess Decide	Provides information on collecting and assessing existing site data (Sections 3.4 through 3.9) and potential sources of information (Appendix G)
Scoping Survey	Scoping Data Life Cycle	Plan Implement Assess Decide	Discusses the purpose and general approach for performing scoping surveys, especially as sources of information when planning FSSs (Section 5.2)
Characterization Survey	Characterization Data Life Cycle	Plan Implement Assess Decide	Discusses the purpose and general approach for performing characterization surveys, especially as sources of information when planning FSSs (Section 5.3)
Remedial Action Support Survey	Remedial Action Data Life Cycle	Plan Implement Assess Decide	Discusses the purpose and general approach for performing remedial action support surveys, especially as sources of information when planning FSSs (Section 5.4)
FSS	Final Status Data Life Cycle	Plan Implement Assess Decide	Provides detailed guidance for planning final status surveys (Chapter 4 and Section 5.5), selecting measurement techniques (Chapters 6 and 7, and Appendix H), and assessing the data collected during FSSs (Chapters 8 and 9)

Notes:

FSS – Final Status Survey

Section numbers refer to chapters in the *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM)

TABLE 5-2

SURVEY STRATEGIES

Survey Type	Minimum Survey Requirement	Sampling and/or Direct Measurements (Note 2)	Minimum Scanning Requirements	Static Measurements	Surface Scans	Exposure Rates	Smears (Note 3)	Media Samples (Note 4)	General Operational Surveys (Note 5)
Scoping (Note 1)	N/A	Random and Additional Biased	Judgmental	X	X	X	I	O	
Characterization (Note 1)	N/A	Systematic and Additional Biased	Judgmental	X	X	X	I	O	
Remedial Action Support	N/A	Random and Biased	Judgmental						X
Final Status	Class 1	Systematic with Random Start	100% Coverage	X	X	X	I	O	
	Class 2	Systematic with Random Start	50% Coverage	X	X	X	I	O	
	Class 3	Random	25% Coverage	X	X	X	I	O	

Notes:

I = indoor surveys; O = outdoor surveys; X = both

Note 1: Reference HRA for HPS (NAVSEA, 2004).

Note 2: Additional locations will be chosen based on history and the judgment of the radiological technician. The minimum number of sample points will be calculated as in Section 5.3.3.

Note 3: In addition to the smears taken at each randomly or systematically determined sampling point, smear sampling will be performed on floor drains, exhaust fans, work benches, sinks, and other suspect locations.

Note 4: Indoor locations may be chosen based on scanning results and the judgment of the radiological technician.

Note 5: General operation surveys may include static measurements, surface samples, exposure rates, smears, and media samples.

HPS – Hunters Point Shipyard

HRA – Historical Radiological Assessment

MARSSIM – Multi-Agency Radiation Survey and Site Investigation Manual

NAVSEA – Naval Sea Systems Command

N/A – not applicable

survey units could be pooled for an overall building comparison to the release limits rather than comparing an individual survey unit to the release limit.

- **Wilcoxon Rank Sum test** – The WRS test is a two-sample, non-parametric procedure that can be used to evaluate compliance when the contaminant is present in background. The WRS test can be used as a two-sample test to compare means between samples (contamination concentration measured in reference background materials vs. the same parameter measured in site investigative materials) when either or both sampling distributions deviate significantly from normal.
- **Normal means test** – This is the traditional two-sample t-test based on the central limit theorem (i.e., normality). It can be used to assess compliance, derive confidence intervals, and compare between samples (mean removable surface contamination concentration in one survey unit vs. the same parameter measured in another survey unit) when both sample distributions are normal or do not deviate appreciably from normality.

Both scan and fixed measurements are subject to the elevated measurement comparison. The result of this comparison is not conclusive as to whether the survey unit meets or exceeds the release criterion, but is a flag or trigger for further investigation. This comparison is described in Section 6.1.

5.5 DECISION MAKING

5.5.1 Scoping and Characterization Surveys

For a scoping survey, the decision rule is, "If the survey results meet the criteria defined in the TSPs, then design and perform an optimized FSS. If the survey results do not meet the criteria defined in the TSPs, then design and perform an optimized characterization survey." In practice, most scoping surveys will be tested against DCGLs. If no contamination above the DCGL is found, then the survey data will be used in an FSS. If contamination is found, then a characterization survey would be performed.

For a characterization survey, the decision rule is, "If the survey results meet the criteria defined in the TSPs, then design and perform an optimized FSS. If the survey results do not meet the criteria defined in the TSPs, then perform remedial action." If no contamination above the DCGL is found, then the survey data would be used in an FSS.

5.5.2 Remedial Action Support Surveys

The decision rule is, "If the survey results indicate that the remediation is complete (as defined in the TSPs), then design and perform an optimized FSS. If the survey results indicate that the remediation is incomplete, then re-evaluate the remedial alternative and continue remediation if necessary."

5.5.3 Final Status Surveys

The results of the statistical testing of the data set for each survey unit will be used to evaluate whether to accept or reject the null hypothesis. Using the MARSSIM Scenario A methodology, the null hypothesis is stated as "the residual activity in the survey unit exceeds the release criteria." Thus, in order to pass the survey unit (that is, release the area), the null hypothesis must be rejected. The objective of FSSs will be to demonstrate that residual radioactivity levels meet the release criterion. In demonstrating that the objective is met, the null hypothesis (H_o) is tested that residual contamination exceeds the release criterion; the alternative hypothesis (H_a) is then tested that residual contamination meets the release criterion.

To validate the use of a test, an evaluation will be made to determine that the data are consistent with the underlying assumptions made for the statistical procedure. Assumptions that can be made in the survey design are: 1) the sample sizes determined for the tests are sufficient to achieve the DQO set for the Type I and Type II error; 2) the data from the reference area or survey unit consist of independent samples from each distribution; 3) the reference area and survey unit data distribution are similar, except for a possible shift in the medians; and 4) whether the data represent a normal or asymmetric distribution. Certain departures from these assumptions may be acceptable when given the actual data and other information about the study. One of the primary advantages of the non-parametric test is that it involves fewer assumptions about the data than the parametric test.

Scenario B methodology as defined in NUREG 1505 (NRC, 1997b) may be used with concurrence from the RASO. If Scenario B is used, specific details will be listed in the TSP as a deviation or exception to the Base-wide plan.

6.0 RELEASE CRITERIA AND INVESTIGATION LEVELS

The release criteria for buildings, structures, material, and land areas at HPS are listed in Table 6-1. Release criteria for equipment and material are taken from Atomic Energy Commission (AEC) *Regulatory Guide 1.86* (1974). Criteria for structures (surfaces) are taken from either *Regulatory Guide 1.86* or a dose-based calculation, whichever is lower. The dose-based calculation will be performed with a dose limit of 25 millirem per year (mrem/y), using the most current version of RESRAD (for outdoor areas) or RESRAD-BUILD (for structures) software packages. Release criteria for soils are taken from EPA's (risk-based) Preliminary Remediation Goals (PRGs) for two future-use scenarios, or from negotiated agreements with regulators, as specified in the *Final, Basewide Removal Action, Action Memorandum, Revision 2006* (Action Memorandum) (Department of the Navy [DON], 2006). Limits for a specific building or area will be given in the TSPs, which are congruent with the criteria defined in the Action Memorandum.

Release criteria organized by survey type are as follows:

- A remedial action support survey will use the release criteria for equipment, material, structures, and soil.
- An FSS will use all the release criteria in Table 6-1, and criteria for scanning surveys known as $DCGL_{EMC}$, discussed below.

6.1 ASSESSING SMALL AREAS OF ELEVATED ACTIVITY

Using guidance from MARSSIM (NUREG-1575; DoD et al., 2000), systematic measurements and sampling, in conjunction with surface scanning, are used to obtain adequate assurance that small areas of elevated radioactivity will satisfy the release criterion for small areas. Under RASO direction, this procedure may be implemented for survey units classified as Class 1.

The $DCGL_W$ is the average concentration across the site that is equivalent to the release criteria, based on dose or risk. The general assumption is that the concentrations of the radionuclides in the source are homogenous. The degree to which any single localized area can be elevated above the average, assuming the average is at the $DCGL_W$, and not invalidate the homogenous assumption is characterized by the small area criteria ($DCGL_{EMC}$).

Values for the $DCGL_{EMC}$ are obtained by modifying the $DCGL_W$ using an area factor that accounts for the difference in area and the resulting change in dose or risk. The area factor is the magnitude by which the concentration within the small area of elevated activity can exceed the $DCGL_W$ while maintaining compliance with the release criterion. The area factor takes into consideration how a smaller area would affect the dose or risk.

The first step in the process is to asses the scan minimum detectable concentration (MDC); this process is described in Section 7.2. The next step is to determine the 'required' scan MDC. The 'required' scan MDC is the product of the $DCGL_W$ and the area factor (also known as the $DCGL_{EMC}$). This can be calculated using Equation 6-1:

Equation 6-1

$$\textit{'required' Scan MDC} = DCGL_{EMC} = (DCGL_W) \times (\textit{Area Factor})$$

The area factor is obtained from dose modeling using RESRAD or RESRAD-BUILD and is determined based on the size of the area bounded by the sample size in the survey unit. This bounded area (*a'*) is simply the survey unit area (in m^2) divided by the number of samples determined in Section 5.3.3. Equation 6-2 is used to derive the size of the area:

Equation 6-2

$$a' = \textit{Survey Unit Area (in } m^2\textit{) / number of samples}$$

The 'actual' scan MDC is then compared to the 'required' scan MDC. If the 'actual' scan MDC is less than the 'required' scan MDC, then no additional samples are required. However, if the 'actual' scan MDC is greater than the 'required' scan MDC, an increase in the number of samples taken may be required. To determine if there is an increase in sample size, the area factor is determined using Equation 6-3:

Equation 6-3

$$\textit{Area Factor} = (\textit{'actual' Scan MDC}) / (DCGL_W)$$

A table of possible area factors is determined by taking the ratio of doses established by using the most current version of RESRAD for outdoor areas, or RESRAD-BUILD for structures. For each radionuclide of concern, all exposure pathways are calculated assuming a concentration of radioactive contamination at the release criteria.

The area of contamination in RESRAD defaults to 10,000 m^2. Other than changing the area (i.e., 1, 3, 10, 30, 100, 300, 1,000, or 3,000 m^2), the RESRAD exposure pathways remain constant. A table of area factors is then computed by taking the ratio of the dose or risk per unit concentration generated by RESRAD for the 10,000 m^2 to that generated for the other areas listed. If the DCGL for residual radioactivity distributed over 10,000 m^2 is multiplied by this value, the resulting concentration distributed over the specified smaller area delivers the same calculated dose.

Indoor area factors are calculated in a similar manner using the most current version of RESRAD-BUILD. The area of contamination in RESRAD-BUILD defaults to 36 m^2. The other

areas to be compared to this value are 1, 4, 9, 16, and 25 m^2. Removable surface contamination is assumed to be 10 percent. No other changes to exposure pathways are to be made between iterations when calculating a table of values.

This area factor is then used to determine the new area bounded by samples *a'* by logarithmically interpolating from a generated table of possible area factors using Equation 6-4 below, and solving for a':

Equation 6-4

$$\ln(a') = \frac{\ln(\frac{y}{z}) \cdot \ln(\frac{AF_x}{AF_z})}{\ln(\frac{AF_y}{AF_z})} + \ln(z)$$

Where:

y=size of area with lower area factor than area factor determined
z=size of area with higher area factor than area factor determined
AF_x=area factor determined
AF_y=area factor of area y
AF_z=area factor of area z

Substituting the new bounded area *a'* into Equation 6-5 provides the increased number of samples required, if any:

Equation 6-5

Additional number of samples required = Survey Unit Area (in m^2) / (a')

The additional number of samples required, in addition to the number required for a particular statistical test from Section 5.3.3, will form the total number of samples required for a particular survey unit when using elevated measurement comparisons. This new total number of samples required will then be applied to the systematic sampling pattern described in Section 4.4 to determine the grid spacing.

6.2 ASSESSING MULTIPLE RADIONUCLIDES

When multiple radionuclides are present, either the more conservative of the individual DCGLs or a combined DCGL will be used, as directed by the RASO. A combined DCGL is calculated using Equation 6-6.

Equation 6-6

$$\text{Combined DCGL} = \frac{1}{\frac{f_1}{DCGL_1} + \frac{f_2}{DCGL_2} + \ldots + \frac{f_n}{DCGL_n}}$$

Where f_n is the anticipated fraction of each radionuclide vs. the total, and $DCGL_n$ is the DCGL for each radionuclide present, the sum of f_1, f_2,…f_n equals one.

6.2.1 $DCGL_W$ for Multiple Radionuclides

As stated in MARSSIM (NUREG-1575; DoD et al., 2000) the $DCGL_W$, when using multiple radionuclides, is established by definition at 1.0. The unity rule, represented in the expression below (Equation 6-7), is satisfied when the radionuclide mixture yields a combined fractional concentration limit that is less than or equal to one. Statistical tests will be used to prove that the total sum of all radionuclides does not exceed the release criteria.

6.2.2 Determination of LBGR for Multiple Radionuclides

The LBGR is the net median concentration of the contaminant in the survey unit. Since this value is unknown, MARSSIM (NUREG-1575; DoD et al., 2000) suggests using a value for the LBGR of half the DCGL during planning purposes. However, once the median concentration activity in the survey unit is established, this value is used as a ratio to the lowest DCGL for the decay method to determine the LBGR. Equation 6-7, taken from MARSSIM, gives the method used to determine the LBGR:

Equation 6-7

$$LBGR = \frac{C_1}{DCGL_1} + \frac{C_2}{DCGL_2} + \frac{C_2}{DCGL_2} + \ldots + \frac{C_i}{DCGL_i} \leq 1$$

Where: C_i = *Median Concentration of Radionuclide "i"*
$DCGL_i$ = *DCGL of Radionuclide "i"*

6.2.3 Determination of Standard Deviation for Multiple Radionuclides

There is no estimate of the standard deviation of the contaminant in a survey unit, especially if no contaminant is initially expected or if concentrations of radionuclides are spatially unrelated. Therefore, σ is assigned the value of the standard deviation of the adjusted measurement values in the survey unit as shown in Equation 6-8 from Section 6.2.3 of *Decommissioning Health Physics* (Abelquist, 2001):

Equation 6-8

$$\sigma = \sqrt{\left(\frac{\sigma_{C1}}{DCGL_1}\right)^2 + \left(\frac{\sigma_{C2}}{DCGL_2}\right)^2 + \ldots + \left(\frac{\sigma_{Ci}}{DCGL_i}\right)^2}$$

Where: σ_{Ci} = *Standard Deviation from Radionuclide "i"*

$DCGL_i$ = *DCGL of Radionuclide "i"*

6.3 CONVERTING DCGL UNITS

At times, it may be necessary to convert the DCGL from picocuries per gram (pCi/g) to counts per minute (cpm) in order to calculate the number of samples required in a given survey unit. To perform this conversion, an arbitrary concentration of the radionuclide is divided by the associated exposure rate produced by the concentration (as identified in Section 7.2.8). The resulting number is then divided by the average net cpm per microroentgen per hour (µR/hr) for the detector being used. Once the number is derived, the release criteria is divided by this number, as shown in Equation 6-9 below.

Equation 6-9

$$cpm = \frac{DCGL}{DCGL_{AC} / M * DCGL_{AC} / \mu Rcpm}$$

Where:

$DCGL$ = release criteria (pCi/g)

$DCGL_{AC}$ = arbitrary concentration of radionuclide (pCi/g)

M = exposure rate calculated by MicroShield™ (Grove Engineering, 1996)

$\mu Rcpm$ = counts per minute per µR/hr for the detector

6.4 INVESTIGATION LEVELS

Investigation levels are specific levels of radioactivity used to indicate when additional investigation may be necessary. Investigation levels also serve as a quality control check. For example, in addition to indicating potential contamination, a measurement that exceeds the investigation level may indicate that the survey unit has been improperly classified or may indicate a failing instrument.

When determining an investigation level using a statistical-based parameter (e.g., standard deviation) the following may be considered: survey objectives, underlying radionuclide distributions (e.g., normal, log normal, non-parametric), data population descriptors (e.g., standard deviation, mean, median), and prior survey and historical information.

When an investigation level is exceeded, the measurement will be confirmed to ensure that the initial measurement/sample actually exceeds the particular investigation level. This will involve taking further measurements to confirm the initial result, and as appropriate, to quantify the area of elevated residual radioactivity.

6.4.1 Investigation Levels for Gamma Radiation Surveys

For gamma surveys the investigation level will normally be established at the reference area mean + 3σ, where σ is the standard deviation of the gamma readings in the reference area.

6.4.2 Investigation Levels for Alpha and Beta Radiation Surveys

For alpha and beta surveys, the investigation level will be the $DCGL_W$, or a statistical-based parameter (e.g., reference area mean + 3σ), if used.

TABLE 6-1

RELEASE CRITERIA

Radionuclide	Surfaces			Soil[d] (pCi/g)				Water[h] (pCi/L)
	Equipment, Waste (dpm/100 cm^2)[a]	Structures (dpm/100 cm^2)[b]	Residual Dose (mrem/yr)[c]	Outdoor Worker (pCi/g)[e]	Residual Dose (mrem/yr)[c]	Residential (pCi/g)[e]	Residual Dose (mrem/yr)[c]	
Americium-241	100	100	18.7	5.67	0.8661	1.36	24.84	15
Cesium-137	5,000	5,000	1.72	0.113	0.2142	0.113	0.2561	119
Cobalt-60	5,000	5,000	6.01	0.0602	0.5164	0.0361	0.3918	100
Europium-152	5,000	5,000	3.21	0.13[f]	0.5018	0.13[f]	0.502	60
Europium-154	5,000	5,000	3.49	0.23[f]	0.9593	0.23[f]	0.9599	200
Plutonium-239	100	100	18.1	14.0	1.743	2.59	1.138	15
Radium-226	100	100	0.612	1.0[g]	6.342	1.0[g]	14.59	5[i]
Strontium-90	1,000	1,000	0.685	10.8	0.1931	0.331	1.648	8
Thorium-232	1,000	36.5	24.9	2.7	24.91	1.69	25	15
Tritium	5,000	5,000	0.00053	4.23	0.00179	2.28	0.05263	20,000
Uranium-235+D	5,000	488	25	0.398	0.178	0.195	0.8453	30

Notes:

Criteria for other nuclides will be listed in TSPs, if needed.

[a] These limits are based on AEC *Regulatory Guide 1.86* (1974). Limits for removable surface activity are 20 percent of these values.

[b] These limits are based on 25 mrem/yr, using RESRAD-Build Version 3.3 or *Regulatory Guide 1.86*, whichever is lower.

[c] The resulting dose is based on modeling using RESRAD-Build Version 3.3 or RESRAD Version 6.3, with radon pathways turned off.

[d] EPA PRGs for two future-use scenarios.

[e] The on-site and off-site laboratory will ensure that the MDA meets the listed release criteria by increasing sample size or counting time as necessary. The MDA is defined as the lowest net response level, in counts, that can be seen with a fixed level of certainty, customarily 95 percent. The MDA is calculated per sample by considering background counts, amount of sample used, and counting time.

[f] Based on EPA-decay corrected PRGs for commercial reuse and a previous action memorandum (TtEMI, 2000, 2001).

[g] Limit is 1 pCi/g above background, per agreement with EPA.

[h] Release criteria for water have been derived from *Radionuclides Notice of Data Availability Technical Document*, (EPA, 2000) by comparing the limits from two criteria and using the most conservative limit.

[i] Limit is for total radium concentration.

AEC – Atomic Energy Commission
cm^2 – square centimeters
dpm – disintegrations per minute
EPA – U.S. Environmental Protection Agency
MDA – minimum detectable activity
mrem/y – millirem per year
pCi/g – picocurie per gram
PRG – Preliminary Remediation Goal
TSP – Task-specific Plan

7.0 INSTRUMENTATION

Instruments will be selected that are suitable for the physical and environmental conditions at the site. The instruments and measurement methods selected will be able to detect the radionuclide of concern or radiation types of interest, and are, in relation to the survey or analytical technique, capable of measuring levels sufficient to support the DQOs. Tables 7-1 and 7-2 identify the instrumentation resources available to support the survey objectives.

7.1 FIELD SURVEY INSTRUMENTS

Portable survey instruments will be used to perform measurements in the field. Table 7-1 lists the types of portable survey equipment expected to be used during survey activities at HPS.

7.1.1 Calibration

Portable survey instrument calibration will be completed on an annual frequency. Instrument calibration will also be performed after repairs or modifications have been performed on the instrument. The instrument will be calibrated in accordance with the manufacturer's recommended method.

7.1.2 Daily Performance

Prior to use of the portable survey instruments, calibration verification, physical inspection, battery check, and source-response check will be performed.

All portable survey instruments will have a current calibration label that will be verified daily prior to use of the instrument.

Physical inspection of the portable survey instrument will include:

- General physical condition of the instrument and detector prior to each use
- Knobs, buttons, cables, connectors
- Meter movements/displays
- Instrument cases
- Probe/probe window(s)
- Other physical properties that may affect the proper operation of the instrument or detector

Any portable survey instrument or detector having a questionable physical condition will not be used until the problems have been corrected.

A battery check will be performed to ensure that sufficient voltage is being supplied to the detector and instrument circuitry for proper operation. This check will be performed in accordance with the instrument's operations manual.

The instrument will be exposed to the appropriate (alpha, beta, gamma) check source to verify that the instrument response is within the +/- 20 percent range determined during the initial response check.

The results of the daily operation checks discussed above will be documented. Instruments that do not pass the daily operation checks will be removed from service until all deficiencies have been corrected.

7.1.3 Instruments for Surface Scan Surveys for Alpha Activity

Scan surveys for alpha radiation will be performed using either a Ludlum Model 2350-1 or Ludlum Model 2360 data logger (or equivalent) equipped with either a Ludlum Model 43-68 or Model 43-37 alpha-beta gas proportional probes (or equivalent) or a Ludlum Model 43-89 ZnS(Ag) plastic scintillation detector (or equivalent).

7.1.4 Instruments for Surface Scan Surveys for Beta Activity

Scan surveys for beta radiation will be performed using either a Ludlum Model 2350-1 or Ludlum Model 2360 data logger (or equivalent) equipped with either a Ludlum Model 43-68 or Model 43-37 alpha-beta gas proportional probes (or equivalent) or a Ludlum 43-89 ZnS(Ag) plastic scintillation detector (or equivalent).

7.1.5 Instruments for Direct Measurement Static Surveys for Alpha Activity

Static surveys for alpha radiation will be performed using either a Ludlum Model 2350-1 or Ludlum Model 2360 data logger (or equivalent) equipped with either a Ludlum Model 43-68 or Model 43-37 alpha-beta gas proportional probes (or equivalent) or a Ludlum Model 43-89 ZnS(Ag) plastic scintillation detector (or equivalent).

7.1.6 Instruments for Direct Measurement Static Surveys for Beta Activity

Static surveys for beta radiation will be performed using either a Ludlum Model 2350-1 or Ludlum Model 2360 data logger (or equivalent) equipped with either a Ludlum Model 43-68 or Model 43-37 alpha-beta gas proportional probes (or equivalent) or a Ludlum Model 43-89 ZnS(Ag) plastic scintillation detector (or equivalent).

7.1.7 Instruments for Scan Surveys for Gamma Activity

Scan surveys for gamma radiation will be performed using a Ludlum Model 2350-1 data logger (or equivalent) equipped with a Ludlum Model 44-10 2-inch by 2-inch sodium iodide (NaI) scintillation detector (or equivalent).

7.1.8 Instruments for Direct Measurement Static Surveys for Gamma Activity

Direct measurement static surveys for gamma radiation will be performed using a Ludlum Model 2350-1 (or equivalent) equipped with a Ludlum Model 44-10 2-inch by 2-inch NaI scintillation detector (or equivalent).

7.1.9 Instruments for Direct Measurement Surveys for Beta Gamma Activity

Direct measurement surveys for beta and gamma radiation will be performed using Ludlum Model 3, Model 12, or equivalent, with a model 44-9 Geiger Mueller pancake probe (or equivalent). This instrument combination is normally used for routine surveys associated with operational aspects of decommissioning activities such as monitoring personnel and equipment exiting a radiologically controlled area.

7.1.10 Instrument for Exposure Rate Surveys

Exposure rate surveys are conducted with use of a Ludlum Model 19 MicroR meter (or equivalent). Compatible with anticipated exposure rates, the instrument is equipped with an internally mounted 1-inch by 1-inch NaI scintillation detector that is integral to the meter housing.

7.1.11 Instrument for Portal Monitor Truck Surveys

The Ludlum Model 3500-1000RWM Radiation Monitor System is designed to detect low levels of radiation in loads passing through the system. Two scintillation detectors, each containing approximately 480 cubic inches of plastic detector media, provide coverage to both sides of the vehicle. The detector's large size (48 inches long by 5 inches wide by 2 inches thick) provides a large area for the detection of gamma radiation.

7.2 INSTRUMENTATION EQUATIONS

The following equations are used to calculate efficiencies, MDCs, and minimum detectable count rates (MDCRs).

7.2.1 Instrument Efficiency

The instrument efficiency (ε_i) is defined as the ratio between the net count rate, in cpm, of the instrument and the surface emission rate of the calibration source for a specified geometry. The surface emission rate is the 2π particle fluence that is affected by both the attenuation and backscatter of the radiation emitted from the calibration source.

Equation 7-1 will be used to calculate the instrument efficiency in counts per particle, although efficiency is typically reported as having no units or unitless.

Equation 7-1

$$\varepsilon_i = \frac{R_{S+B} - R_B}{q_{2\pi}\left(\frac{W_A}{S_A}\right)}$$

Where:

R_{S+B} = the gross count rate of the calibration measurement (cpm)
R_B = the background count rate in cpm
$q_{2\pi}$ = surface emission rate of the calibration source (National Institute of Standards and Technology [NIST] traceable) in particles per minute
W_A = active area of the detector window (square centimeters [cm^2])
S_A = area of the source (cm^2)

The instrument efficiency is determined by obtaining static counts with the detector over a calibration source that has a NIST-traceable surface emission rate. The 2π particle fluence rate is corrected for decay, attenuation, and scatter. Then the surface emission rate of the source must be corrected for the area subtended by the probe. Factors that can also affect instrument efficiency are discussed below:

- Efficiency Check Sources. Efficiency check sources that emit alpha or beta radiation with energies similar to those expected from the contaminant in the field (similar to the expected radionuclide(s) of concern) will be selected.
- Source Geometry Factors. Instrument efficiency will usually be determined with an efficiency check source equal to or greater than the area of the probe. If a source smaller than the probe is used, a conversion factor is applied to the MDC to account for the active region of the probe.
- Source-to-Detector Distance. The detector efficiency will be calculated at a source-to-detector distance the same as the detector-to-surface distance used in the field.

7.2.2 Surface Activity Measurements

Surveillance measurements are used to quantify surface activity levels mainly on remaining concrete surfaces. ISO 7503-1 (International Organization for Standardization [ISO], 1988), NUREG/CR-1507 (NRC, 1997b), and Selection and Use of Portable Radiological Survey Instruments for Performing In-Situ Radiological Assessments in Support of Decommissioning (American Society for Testing and Materials, 1998) are used as technical guidance to ensure accuracy in the measurement of surface activity.

Equation 7-1a is used to calculate the surface activity in units of disintegrations per minute (dpm) per 100 cm^2.

Equation 7-1a

$$A_S = \frac{R_{S+B} - R_B}{\varepsilon_i \varepsilon_s \frac{W_A}{100\ cm^2}}$$

Where:

A_S	=	total surface activity (dpm/100 cm^2)
R_{S+B}	=	the gross count rate of the measurement in cpm
R_B	=	the background count rate in cpm
ε_i	=	the instrument efficiency
ε_s	=	the contaminated surface efficiency
W_A	=	the area of the detector window (cm^2)

7.2.3 Count Detection Probability For Alpha Scans (≤ 126-cm^2 Probe)

Scanning for alpha emitters differs significantly from scanning for beta and gamma emitters in that the expected background response of most alpha detectors is very close to zero. The following sections cover scanning for alpha emitters

Since the time a contaminated area is under the probe varies and the background count rate of some alpha instruments is less than 1 cpm, it is not reasonable to determine a fixed MDC for scanning. Instead, it is more practical to determine the probability of detecting an area of contamination at a predetermined DCGL for given scan rates.

For alpha survey instrumentation with backgrounds ranging from less than 1 to 3 cpm, a single count provides a surveyor sufficient cause to stop and investigate further. Assuming this to be true, the probability of detecting given levels of alpha surface contamination can be calculated by use of Poisson summation statistics.

Given a known scan rate and a surface contamination release limit, the probability of detecting a single count while passing over the contaminated area is given by Equation 7-2:

Equation 7-2

$$P(n \geq 1) = 1 - e^{\frac{GEd}{60v}}$$

Where:

$P(n \geq 1)$ = probability of observing a single count
G = contamination activity (dpm)
E = detector efficiency (4π)
d = width of detector in direction of scan (cm)
v = scan speed (centimeters per second [cm/s])

Once a count is recorded and the guideline level of contamination is present, the surveyor should stop and wait until the probability of getting another count is at least 90 percent. This time interval can be calculated by Equation 7-3:

Equation 7-3

$$t = \frac{13,800}{CAE}$$

Where:

t = time period for static count(s)
C = contamination guideline (dpm/100 cm^2)
A = physical probe area (cm^2)
E = detector efficiency (4π)

7.2.4 Count Detection Probability For Alpha Scans (582-cm^2 Probe)

The larger (582 cm^2) gas-proportional detectors have background count rates on the order of 5 to 10 cpm, and a single count will not cause a surveyor to investigate further. A counting period long enough to establish that a single count indicates an elevated contamination level would be prohibitively inefficient. For these types of instruments, the surveyor usually will need to get at least two counts while passing over the source area before stopping for further investigation.

Assuming this to be a valid assumption, the probability of getting two or more counts can be calculated by Equation 7-4:

Equation 7-4

$$P(n \geq 2) = 1 - \left[1 + \frac{(GE + B)t}{60}\right]\left[e^{\frac{-(GE+B)t}{60}}\right]$$

Where:

$P(n \geq 2)$ = probability of getting two or more counts during the time interval t
t = time interval (s)
G = contamination activity (dpm)
E = detector efficiency (4π)
B = background count rate (cpm)

7.2.5 Minimal Detectable Count Rate and Minimum Detectable Concentration for Beta Scans

The minimum detectable number of net source counts in the scan interval can be arrived at by multiplying the square root of the number of background counts (in the scan interval) by the detectability value associated with the desired performance (as reflected in d') as shown in Equation 7-5.

Equation 7-5

$$MDCR = \mathrm{d}'\sqrt{\mathrm{b_i}}\left(\frac{60}{i}\right)$$

Where:

d' = index of sensitivity (α and β errors [performance criteria])
b_i = number of background counts in scan time interval (count)
i = scan or observation interval (s)

The required rate of true positives will be 95 percent, and the false positives will be 5 percent. From Table 6.5 of MARSSIM, the value of d', representing this performance goal, is 3.28.

The minimum detectable number of net source counts in the interval is given by S_i. Therefore, for an ideal observer, the number of source counts required for a specified level of performance can be arrived at by multiplying the square root of the number of background counts by the detectability value associated with the desired performance (as reflected in d'), as shown in Equation 7-5a below.

Equation 7-5a

$$S_i = d'\sqrt{b_i}$$

The scan MDC is determined from the MDCR by applying conversion factors that account for detector and surface characteristics and surveyor efficiency. As discussed below, the MDCR accounts for the background level, performance criteria (d′), and observation interval. The observation interval during scanning is the actual time that the detector can respond to the contamination source. This interval depends on the scan speed, detector size in the direction of the scan, and area of elevated activity.

The scan MDC for structure surfaces is calculated using Equation 7-6.

Equation 7-6

$$Scan\ MDC = \frac{MDCR}{\sqrt{p}\ \varepsilon_i \varepsilon_s \frac{W_A}{100\ cm^2}}$$

Where:

MDCR is discussed above
p = surveyor efficiency factor
ε_i = instrument efficiency (count per particle)
ε_s = contaminated surface efficiency (particle per disintegration)
W_A = area of the detector window (cm^2)

7.2.6 MDC for Static Alpha and Beta Counts

The static MDC is the level of radioactivity practically achievable by the overall measurement process. Equation 7-7 is used to calculate instrument MDC in dpm per 100 cm^2 when the background and sample are counted for the same time intervals.

Equation 7-7

$$MDC = \frac{3 + 4.65\sqrt{R_B T_B}}{\varepsilon_s \varepsilon_i \frac{W_A}{100} T_B}$$

Where:

R_B = background count rate (cpm)
T_B = background counting time (min)
ε_i = instrument efficiency (count per particle)
ε_s = contaminated surface efficiency (particle per disintegration)
W_A = active area of the detector window (cm^2)

In Equation 7-7, W_A is the size of the "active" area of the detector window. If the area of the detector window (cm^2) does not equal 100 cm^2, it is necessary to convert the detector response to units of dpm per 100 cm^2.

If the background and sample are counted for different time intervals, Equation 7-8 is used to calculate the MDC in dpm per 100 cm^2.

Equation 7-8

$$MDC = \frac{3 + 3.29\sqrt{R_B T_{S+B}\left(1 + \frac{T_{S+B}}{T_B}\right)}}{\varepsilon_i \varepsilon_s \frac{W_A}{100\ cm^2} T_{S+B}}$$

Where:

R_B	=	background count rate (cpm)
T_B	=	background counting time (min)
T_{S+B}	=	sample counting time (min)
ε_i	=	instrument efficiency (count per particle)
ε_s	=	contaminated surface efficiency (particle per disintegration)
W_A	=	active area of the detector window (cm^2)

7.2.7 Surface Efficiency (ε_s) for Surface Activity Measurements

The surface efficiency term in the preceding equations is used to determine the 4π total efficiency for a particular surface and condition. Suitable values are based on the radiation and radiation energy, and are primarily impacted by the backscatter and self-absorption characteristics of the surface on which the contamination exists in the field. Backscatter is most affected by the energy of the radiation and the density of the surface material. Self-absorption characteristics or attenuation are also a function of the radiation's energy and surface condition. Surfaces typically encountered in the field include concrete, asphalt, wood, drywall, plaster, carpet, and metal. Surface conditions include both physical effects, such as scabbled concrete, and the effect of surface coatings: dust, paint, rust, water, and oil.

In the absence of experimentally determined surface efficiencies, ISO-7503-1 (ISO,, 1988) and NUREG-1507 (NRC, 1997a), provide conservative recommendations for surface efficiencies. ISO-7503-1 recommends a surface efficiency of 0.5 for maximum beta energies exceeding 0.5 megaelectron volt (MeV) and to use a surface efficiency of 0.25 for beta energies between 0.15 and 0.4 MeV and for alpha emitters (ISO, 1998; NRC, 1997a). NUREG-1507 provides surface efficiencies based on studies performed for the NRC. In general, NUREG-1507 indicates that the ISO rule-of-thumb for surface efficiencies is conservative, particularly for beta-emitting

radionuclides with end-point energies between 0.25 MeV and 0.4 MeV. Therefore at HPS a surface efficiency of 0.25 will be used for alpha and beta emitters.

7.2.8 MDC for Gamma Scans of Surface Areas

The scan MDC (in pCi/g) for land areas is based on the area of elevated activity, depth of contamination, and the radionuclide (energy and yield of gamma emissions.) To establish the scan MDC, the relationship between the detector's net count rate to net exposure rate must be established first. This is accomplished by determining the MDCR using Equation 7-5 and then applying a surveyor efficiency factor p to get the $MDCR_{Surveyor}$ as show below in Equation 7-9:

Equation 7-9

$$MDCR_{Surveyor} = MDCR / \sqrt{p}$$

The $MDCR_{Surveyor}$ is then converted into the corresponding minimum detectable exposure rate (MDER) by use of a calibration constant specific to the detector being used and the radionuclide of concern. For example, when used with the Ludlum Model 2350-1, the calibration records for the Ludlum Model 44-10 2-inch by 2-inch NaI scintillation detector provide a calibration constant that can be used to determine the ratio of cpm to µR/hr, as shown in Equation 7-10 below:

Equation 7-10

$$MDER\ (\mu R / hr) = \frac{MDCR_{Surveyor} * 6 \times 10^{7}}{cc}$$

Where:

$MDCR_{Surveyor}$ = as calculated in Equation 7-9
$6x10^{7}$ = a conversion factor accounting for differences in time and activity units ([µR-min]/[R-hr])
cc = calibration constant ([counts]/[R])

Next, the relationship between the radionuclide concentration and exposure rate is established. This is accomplished by modeling (using MicroShield) to determine the net exposure rate produced by the radionuclide at a distance above the ground. The factors considered in modeling include:

- The dose point above the surface
- The density of material in grams per cubic centimeter (g/cm^3)

- DCGL of the radionuclide of concern in pCi/g
- The depth of detection for the DCGL
- The circular dimension of the cylindrical area of detector capability (m^2)

The concentration of the radionuclide of concern (Scan MDC) necessary to yield the MDER may be calculated by taking the ratio of the MDER to the exposure rate calculated by MicroShield or Monte Carlo *N*-Particle code, as shown in Equation 7-11 below:

Equation 7-11

$$Scan\ MDC\,(pCi/g) = \frac{DCGL\ pCi/g * MDER\,\mu R/hr}{Microshield\ Exposure\ Rate\,\mu R/hr}$$

7.2.9 Minimum Detectable Count Rate for Static Gamma Counts

For gamma surveys, MDCR, rather than MDC, is calculated in cpm. If the background and sample are counted for the time intervals, Equation 7-12 is used to calculate the MDCR.

Equation 7-12

$$MDCR = \frac{3 + 4.65\sqrt{R_B T_B}}{T_B}$$

Where:

$3 + 4.65$	=	constant factor provided by MARSSIM
R_B	=	background count rate (cpm)
T_B	=	background counting time (min)

TSPs will not normally be designed to use different background and sample count times for gamma scan surveys; any deviation from this requires RASO approval, and notation in the TSP and final reports as an exception to the Base-wide plan. If the background and sample are counted for different time intervals, Equation 7-13 is used to calculate the MDC.

Equation 7-13

$$MDC = \frac{3 + 3.29\sqrt{R_B \cdot T_{S+B} \cdot (1 + \frac{T_{S+B}}{T_B})}}{T_{S+B}}$$

Where:

$3 + 3.29$	=	constant factor provided by MARSSIM
R_B	=	background count rate (cpm)
T_{S+B}	=	background counting time (min)
T_B	=	background counting time (min)

7.3 LABORATORY INSTRUMENTS

Laboratory equipment will be used to analyze samples collected in the field. Table 7-2 lists the types of laboratory equipment expected to be used during survey activities at HPS.

7.3.1 Quality Assurance Checks

Quality assurance checks shall be performed on laboratory instrumentation to ensure proper operation and to maintain calibration. The quality checks shall be documented, reviewed, and maintained. Data trends outside the tolerance limits shall be investigated to determine the cause and potential effect on measurement results.

7.3.2 Gross Beta-gamma-alpha Loose Surface Contamination Surveys

Smear samples will be processed using a Protean Instrument Corporation or a Canberra, Inc. (Tennelec) gas-flow proportional alpha/beta radiation counter (or equivalent) that features a low-background counting chamber. A microprocessor allows for data processing, and the unit provides a full range of simultaneous alpha and beta analysis at levels required for environmental release surveillance. Data is reported in units of dpm per 100 cm^2.

As a backup to the gas-flow proportional counters, a Ludlum Model 2929 scaler with a Model 43-10-1 ZnS(Ag) scintillation probe (or equivalent) may be used. Data is reported in units of dpm.

7.3.3 Gamma Spectroscopy

Gamma spectroscopy analysis is performed using EG&G ORTEC® detector systems equipped with beryllium end caps (windows), which allows for enhanced quantification of low-energy gammas (such as radium-226 [^{226}Ra]). Hardware features include a High-Purity Germanium Detector (gamma photon detector) supported by a multi-channel analyzer and analysis software. Instrument hardware is calibrated using a multi-energy NIST- traceable source ranging from 50 kiloelectron volts (keV) to 2.6 MeV. All results are reported in pCi/g, picocuries per milliliter (pCi/mL), or picocuries per liter (pCi/L), depending on the media analyzed. The Laboratory Manager reviews all data results, including energy spectrums, for quality assurance and to verify count integration, efficiency, and background corrections, as well as the identification of

overlapping peaks. If there is any question on the analysis results, the sample is reprocessed and possibly counted for a longer interval.

7.3.4 Liquid Scintillation Analysis

Liquid scintillation counting will be accomplished using a Perkin Elmer Tri-Carb 3100TR (or equivalent) with a photo-multiplier array and associated hardware to identify beta emissions in the range of 2 keV to 2000 keV. The system is calibrated using NIST-traceable sources. The results are identified in dpm or pCi/g and grouped by energy.

7.3.5 Strontium-90 Analysis

Strontium-90 analysis will be performed by chemical separation using Northwest Technologies, Inc.'s (NWT's) approved SOPs, and may use the same instrument as that used for gross beta-gamma-alpha loose surface contamination. The NWT procedure describes a method for separation and superscript measurement of strontium-90 (^{90}Sr) in various media through the use of a specialized cation resin. The extraction system in the proprietary specialized resin is 1.0 molar 4,4'(5')-di-t-butylcyclohexano 18-crown-6 (crown ether) in 1-octanol. A 40 percent organic solution is loaded onto an inert chromatographic support. The bed density of strontium resin is approximately 0.35 grams per milliliter. The radioactive ^{90}Sr is separated using the specialized resin prior to gas proportional counting. Small amounts of ^{90}Sr tracer are used to monitor method yields and correct results to improve precision and accuracy. The results of ^{90}Sr analysis are reported in pCi/g, pCi/mL, or pCi/L, depending on the media analyzed.

7.3.6 Alpha Spectroscopy Analysis

Alpha-emitting radioisotopes spontaneously produce alpha particles (or helium-4 nuclei) at characteristic energies usually between 3 and 6 MeV. Alpha particles are heavy, charged particles. Because they are large and slow, alpha particles readily lose energy in materials. Any physical medium between the alpha-emitting radionuclide and the active portion of the detector will absorb some of the alpha particle energy. These absorption characteristics, which manifest themselves both within the sample and with any materials between the sample and the active detector volume, cause a characteristic tailing in the alpha peak. The peaks tend to have an asymmetric shape rather than the Gaussian shape typical in gamma spectroscopy. The analyst must take precautions to reduce the size of the tail. Specifically, the samples must be counted in a vacuum and be as thin as possible to avoid self absorption.

The alpha particle energies of many isotopes differ by as little as 10 to 20 keV. Because this is near the resolution of the silicon detectors used in alpha spectrometers, such elements must be chemically separated before analysis. This chemical separation is intended to isolate specific elements in the sample to minimize interferences between multiple alpha-emitting nuclides. In order to account for the inevitable loss of the sample during separation, a known quantity of a

NIST-traceable specific isotope or tracer is added to the sample. These tracers are isotopes of one of the elements under study (i.e., uranium-232 for uranium quantification). Since all isotopes of an element behave chemically alike, the percent of tracer lost in the chemical separation process is equal to the percent of sample lost, assuming the tracer is homogeneously mixed with the sample and is brought into chemical equilibrium with the sample.

In order to obtain the thinnest sample possible, thereby minimizing self attenuation, samples must be properly mounted. After the sample is placed into the chamber and the chamber evacuated, data are acquired from the sample for a preset period of time. Because of the low activities involved, acquisitions are often very long to achieve the desired minimum detectable activity. After data is acquired, analysis software processes the spectrum and quantifies the results for the isotopes of interest. Analysis can consist of simple count integration and efficiency correction and may also involve extensive background corrections, compensation for various chemical process characteristics, processing of overlapping peaks, etc. Analysis will be performed by chemical separation using subcontractor approved SOPs, using the EG&G ORTEC Octête® Alpha Spectroscopy system, combined with Alpha-Vision® software. The results of alpha spectroscopy analysis are reported in pCi/g, pCi/mL, or pCi/L, depending on the media analyzed.

TABLE 7-1

PORTABLE SURVEY INSTRUMENTS

Measurement/ Technique	Primary Use	Type of Instrumentation		Typical Background	Typical Total Efficiency (%)	Detection Sensitivity	Typical Minimum Detectable Concentration
		Detector Type and Ludlum Model Number(s)	Meter Description and Ludlum Model Number(s)				
Surface alpha/beta scans	Structures	Large-area gas - proportional 43-37 (582 cm^2)	Data logger 2350-1, 2360	800-1,200 cpm β 10-15 cpm α	~12 β total efficiency ~12 α total efficiency	474 dpm/100 cm^2 β 56 dpm/100 cm^2 α	900 dpm/ 100 cm^2 β 80 dpm/ 100 cm^2 α
	Equipment, Materials, Debris, Structures	Large-area gas - proportional 43-68 (126 cm^2)		150-250 cpm β 0-2 cpm α	~6 β total efficiency ~6 α total efficiency	900 dpm/100 cm^2 β 100 dpm/100 cm^2 α	553 dpm/ 100 cm^2 β 53 dpm/ 100 cm^2 α
Direct measurement static alpha/beta		Scintillation, Ludlum Model 43-89 (100 cm^2)		100-200 cpm β 0-5 cpm α			
Surface gamma scans	Equipment, Materials, Debris Structures	NaI 2-inch x 2-inch scintillation Ludlum Model 44-10	Data logger 2350-1	5,000 cpm γ	N/A	1,500 cpm γ 1.6 pCi/g ^{137}Cs 0.58 pCi/g ^{226}Ra	353 cpm γ
Direct measurement static gamma							
Towed Array surface gamma scans	Surfaces	(12) NaI 2-inch x 2-inch scintillation Ludlum Model 44-10	Data logger 4612	5,000 cpm γ	N/A	1.6 pCi/g ^{137}Cs 0.58 pCi/g ^{226}Ra	353 cpm γ
Surface beta/gamma scans	Equipment, Materials, Debris, Personnel	Geiger-Mueller Ludlum Model 44-9	Ratemeter 3	50 to 100 cpm β γ	~10 β γ total efficiency	~ 1,000 dpm per probe area β γ	358 dpm/100 cm^2 β γ
Direct measurement static beta/gamma							

TABLE 7-1

PORTABLE SURVEY INSTRUMENTS

Measurement/ Technique	Primary Use	Type of Instrumentation		Typical Background	Typical Total Efficiency (%)	Detection Sensitivity	Typical Minimum Detectable Concentration
		Detector Type and Ludlum Model Number(s)	Meter Description and Ludlum Model Number(s)				
Exposure rates	All Inclusive	MicroR Meter with integral 1-inch x 1-inch NaI scintillation	Ratemeter 19	7-8 µR/hr	N/A	2 µR/hr	N/A

Notes:

α – alpha
β – beta
γ – gamma
µR/hr – microroentgen per hour
^{137}Cs – cesium-137
^{226}Ra – radium-226
cm^2 – square centimeters
cpm – counts per minute
dpm – disintegrations per minute
N/A – not applicable
NaI – sodium iodide

TABLE 7-2

ON-SITE LABORATORY INSTRUMENTATION

Laboratory Instruments				
Measurement/ Technique	**Type of Instrumentation***	**Typical Background**	**Typical Efficiency (%)**	**Detection Sensitivity**
Gamma spectroscopy	EG&G Ortec Beryllium Window	N/A	N/A	0.05 pCi/g (for ^{137}Cs) 0.5 pCi/g (for ^{226}Ra)
Strontium Analyses	Protean Instrument Corp. Low-background gas-flow proportional counter	N/A	~30%	0.23 pCi/g
Alpha Spectroscopy	EG&G Ortec Octête ™ Alpha Spectrometer	N/A	N/A	0.011 pCi/g (for ^{226}Ra and ^{239}Pu)
Gross beta-gamma-alpha on smears (Smears)	Protean Instrument Corp. Low-background gas-flow proportional counter	1-5 cpm β 0-0.5 cpm α	~62 β ~27 α	4-10 dpm/100 cm^2 β 2-5 dpm/100 cm^2 α
	Canberra (Tennelec) Low-background gas-flow proportional counter	1-5 cpm β 0-0.5 cpm α	~33 β ~33 α	10 dpm/100 cm^2 β 5 dpm/100 cm^2 α
	Ludlum Model 2929 ZnS(Ag) detector	>80 cpm β >3 cpm α	16 β 26 α	100 dpm/100 cm^2 β 10 dpm/100 cm^2 α
Liquid scintillation analysis	Perkin Elmer Tri-Carb 3100TR liquid scintillation counter	20 dpm	60	25 dpm 2000 pCi/g

Notes:

* or equivalent

Types of radiation: α - alpha, β - beta
cm^2 – square centimeters
cpm – counts per minute
^{137}Cs – cesium-137
dpm – disintegrations per minute
N/A – not applicable
^{226}Ra – radium-226
pCi/g – picocurie per gram
^{239}Pu – plutonium-239

TABLE 7-3

EXAMPLES OF FIELD RADIOLOGICAL SURVEY INSTRUMENT CALCULATIONS

Measurement Technique	Calculation Type and Applicable Equations	Meter [Note 1]	Detector [Note 1]	Probe Area (cm^2)	Typical Detector Efficiency (%)	Surface Efficiency (%) [Note 2]	Bkg Count Time (min)	Sample Count Time (min)	Bkg Count Rate (cpm)	Required Detection Sensitivity (dpm/100 cm^2)	Scan Speed (cm/s)	Probe Width (cm)	Scan Interval (s)	Surveyor Efficiency (%)	Bkg Counts Per Scan Interval	Results [Note 3]
Surface alpha scans	Count detection probability for α scans; Equations 7-2, 7-3, or 7-4 (depends on detector area)	Ludlum Model Number(s) 2360 or 2350-1 data logger	Gas-proportional, Ludlum Model 43-37	582	0.120	N/A			10.0	100	1.3	14.0	10.8	N/A		90%
			Gas-proportional, Ludlum Model 43-68	126	0.120				1.0	100	0.7	8.8	12.6			92%
			Scintillation, Ludlum Model 43-89	126	0.130				0.4	100	0.7	7.6	10.9			90%
Surface beta scans	MDC for β scans; Equations 7-5 and 7-6	Ludlum Model Number(s) 2360 or 2350-1 data logger	Gas-proportional, Ludlum Model 43-37	582	0.250	0.25	N/A		800	N/A	1.7	14.0	8.2	0.50	110	974 dpm/100 cm^2
			Gas-proportional, Ludlum Model 43-68	126	0.250	0.25			200		0.2	8.8	44.0	0.50	147	973 dpm/100 cm^2
			Scintillation, Ludlum Model 43-89	126	0.250	0.25			180		0.2	7.6	38.0	0.50	114	993 dpm/100 cm^2
Direct measurement static alpha	MDC for static α counts; Equations 7-7 and 7-8	Ludlum Model Number(s) 2360 or 2350-1 data logger	Gas-proportional, Ludlum Model 43-37	582	0.250	0.25	5	0.3	15.0	N/A						93 dpm/100 cm^2
			Gas-proportional, Ludlum Model 43-68	126	0.250	0.25	5	1.2	2.0							92 dpm/100 cm^2
			Scintillation, Ludlum Model 43-89	126	0.250	0.25	5	0.7	0.4							88 dpm/100 cm^2
Direct measurement static beta	MDC for static β counts; Equations 7-7 and 7-8	Ludlum Model Number(s) 2360 or 2350-1 data logger	Gas-proportional, Ludlum Model 43-37	582	0.250	0.25	5	0.1	1,000	N/A						996 dpm/100 cm^2
			Gas-proportional, Ludlum Model 43-68	126	0.250	0.25	5	0.5	200							953 dpm/100 cm^2
			Scintillation, Ludlum Model 43-89	126	0.250	0.25	5	0.5	180							908 dpm/100 cm^2
Surface gamma scans	MDC for γ scans; Equation 7-9	Ludlum Model Number(s) 2360 or 2350-1 data logger, or 2221 scaler/rate meter	NaI 2"x 2" scintillation, Ludlum Model 44-10	N/A			1	0.017	5,000	N/A						4.8 μR/hr
Direct measurement static gamma	MDCR for static γ counts; Equation 7-10	Ludlum Model Number(s) 2360 or 2350-1 data logger, or 2221 scaler/rate meter	NaI 2"x 2" scintillation, Ludlum Model 44-10	N/A			1	1.0	5,000	N/A						332 cpm (net)
Direct measurement beta/gamma	N/A	Ludlum Model Number 3	Geiger-Mueller, Ludlum Model 44-9	N/A					50	N/A						~1,000 dpm/probe area
Exposure rates	N/A	Ludlum Model Number(s) 19 MicroR Meter	Integral NaI 1"x 1" scintillation	N/A					6 μR/hr	N/A						~2 μR/hr
Truck Portal Monitor	N/A	Ludlum Model Number(s) 3500-1000RWM Radiation Monitor System	Plastic scintillator, ~480 cubic inches (48 inches long by 5 inches wide by 2 inches thick)	N/A						N/A						

TABLE 7-3

EXAMPLES OF FIELD RADIOLOGICAL SURVEY INSTRUMENT CALCULATIONS

Notes: Note 1: or equivalent.

Note 2: 0.25 will be assumed surface efficiencies unless otherwise noted in the TSP.

Note 3: Results for alpha scans reflect the probability of detecting 1 or more counts during the scan interval, as appropriate. Results for other activities reflect the instrument sensitivities calculated using the provided equations, or as provided by the manufacturer where equations in this plan are not applicable.

α - alpha
β - beta
γ - gamma
μR/hr – microroentgen per hour
cm^2 – square centimeters
cm/s – centimeters per second
cpm – counts per minute
dpm – disintegrations per minute
MDC – minimum detectable concentration
MDCR – minimum detectable count rate
min – minutes
N/A – not applicable
NaI – sodium iodide
s – seconds
TSP – Task-specific Plan

8.0 SURVEY IMPLEMENTATION

This section discusses the types of surveys and their implementation in the field with a focus on the methods for conducting each type of survey. The survey procedures described in this section will be performed in accordance with approved standard operating procedures. Additional survey implementation details will be identified in each TSP.

8.1 REFERENCE (BACKGROUND) AREAS

An average background level will be determined by performing measurements at systematic or random locations within the designated background area. The detector probe will be held approximately 10 cm (4 inches) from the surface area for gamma and 0.25 inch from the surface area for alpha/beta radiation. Instrumentation will be allowed to stabilize before background readings are taken. The average of all of the readings taken will determine the background. Background scan ranges, smears, and exposure rates will also be collected for reference data. In some cases, solid samples will need to be collected in the background area for comparative analyses of specific survey units. The same survey methodology and instruments used to collect the background data will be used to perform measurements within survey units.

Data collected in reference areas will be statistically evaluated using a graphical format, such as a frequency distribution chart. The purpose of the evaluation is to ensure that the data collected in the reference area is consistent with a normal distribution and that the variability of the background is not too high. Background variability may be considered high when differences in estimated mean concentration measured in potential reference areas are comparable to screening level DCGLs. NUREG-1505 (NRC, 1997b), Chapter 13, *Demonstrating Indistinguishability from Background*, provides detailed guidance for evaluating reference areas exhibiting high variability.

8.2 SCAN SURVEYS

Scan surveys are an integral part of survey programs conducted to determine contamination levels. The surveys are an evaluation technique performed by moving a detection device over a surface at a specified speed and distance above the surface to detect radiation. It will be used to identify areas that may require additional survey measurements.

8.2.1 Scan Surveys for Alpha/Beta Radiation

Surface scan surveys for alpha and beta radiation will be performed by moving the detector over the surface being surveyed at a rate of approximately 1 inch per second. The detector will be held approximately 0.635 cm (0.25 inch) over the surface being surveyed.

8.2.2 Scan Surveys for Gamma Radiation

Scan measurements are obtained by traversing a path at a maximum speed (scan rate) of approximately 0.5 meter per second (m/s) and slowly moving the detector assembly in a serpentine (S-shaped) pattern, while maintaining the detector approximately 10 cm (4 inches) above the area being surveyed.

8.3 STATIC SURVEYS

Static contamination surveys are used to determine contamination levels on surface areas for scoping, characterization, and/or release surveys. The surveys are an evaluation technique performed by holding a detection device over a surface for a specified time at a set distance to detect radiation.

8.3.1 Static Surveys for Alpha and Beta Surface Activity

Direct measurements will be conducted with the detector approximately 0.635 cm (0.25 inch) above the surface. Count time for conducting the measurement will be dependent upon the isotope of concern.

8.3.2 Static Surveys for Gamma Radiation

Static gamma measurements require positioning the detector assembly approximately 10 cm (4 inches) above the surface and completing a stationary 60-second survey.

8.4 EXPOSURE RATE MEASUREMENTS

These surveys are performed to measure ambient gamma radiation levels. Exposure rate measurements are obtained by holding the detection device approximately 1 m from the surface being surveyed. Instrumentation will be allowed to stabilize before taking the measurement. Instrument stabilization time will vary depending on the instruments used and site conditions.

8.5 SMEAR SAMPLE MEASUREMENTS

Smear sampling will be performed to assess the presence of radioactive contamination that is readily removed from a surface. Smear samples will be taken to evaluate the presence of alpha and beta surface activity. As called for in individual TSPs, smear samples may be collected to evaluate tritium contamination. The procedures for collecting smear samples are discussed in Appendix B, Base-wide Sampling and Analysis Plan.

8.6 SURVEY AND SAMPLE LOCATIONS

Static measurements, smear samples, exposure rate measurements, and media samples will be taken from the same predetermined locations within each survey unit to obtain data for use in FSSs. Section 4.4, Reference Coordinate Systems, and Section 6.1, Assessing Small Areas of Elevated Activity, give further discussion regarding survey and sample locations for FSSs. Static measurement locations for equipment and material surveys are given in TSPs, SOPs, and other Work Instructions.

8.7 EQUIPMENT AND MATERIAL SURVEYS

Equipment and materials surveys will be performed following the methods presented in Sections 8.2 through 8.6. Table 6-1 provides acceptable levels of contamination based on the AEC *Regulatory Guide 1.86* limits. In the event that survey results indicate levels of contamination exceeding the limits listed in Table 6-1 (for surfaces), appropriate decontamination methods will be performed using methods described in SOPs.

8.8 PERSONNEL SURVEYS

Properly trained staff will perform personnel surveys in a pre-designated low-background area before leaving a radiologically controlled area, as specified in the RWP or when deemed necessary by the RCT. Personnel who are not qualified to administer a self-survey will be monitored by a qualified technician. Personnel surveys will be performed using the appropriate survey methods described above and in accordance with appropriate SOPs and TSPs.

8.9 MEDIA SAMPLING

Various samples may be collected for radiological analysis, including soil, water, brick, porcelain, wood, and others. Appendix B, Base-wide Sampling and Analysis Plan, describes the methods for collecting samples, sample numbering, sample labeling, sample shipment, and completion of the associated chain-of-custody and other required documentation. Media samples for gamma spectroscopy, ^{90}Sr analyses, alpha spectrometry, and liquid scintillation analyses will be analyzed on site using instrumentation described in Sections 7.3.3 through 7.3.6. Samples for alpha spectrometry and beta analysis may also be analyzed at an approved off-site laboratory. In addition, 10 percent of the media samples collected will be analyzed at a (different) off-site laboratory, as described in Appendix B, without additional specification in a TSP.

8.10 AIR SAMPLING

As specified in the RWP, airborne activity monitoring (continuous or grab samples) and engineering controls will be necessary during the course of work. In order to control occupational exposures, establish PPE, and determine respiratory-protection requirements,

monitoring and trending for airborne radioactive material will be performed as necessary. Engineered controls will be implemented if required to maintain airborne concentrations below 10 percent of the applicable derived air concentration (DAC) value for the radionuclides of concern (Table 8-1).

If, during the course of work, an airborne concentration exceeds 10 percent of the DAC, ongoing activities will cease and the affected location will be posted until the source of the airborne concentration is eliminated and levels are confirmed to be below 10 percent of the DAC. Air monitoring will be performed using the methods described in the appropriate SOP.

8.11 TRUCK SURVEYS

During the course of work at HPS, soils and debris will be transported via truck to recycling centers, landfills, and other licensed disposal sites. Most of these items and materials will require radiological surveys prior to leaving the site. However, some stockpiles of soil, debris, and miscellaneous materials have not been surveyed because the likelihood of the presence of radioactive materials is very low. As an added measure against inadvertently sending radioactive materials to a landfill or disposal site, trucks carrying material from potentially impacted sites will be surveyed for gamma radiation. Truck surveys will be performed using the methods described in the appropriate SOPs. The RSO will be immediately notified of any truck rejected at the HPS portal monitor.

8.12 GPS MEASUREMENTS

As specified in TSPs, Global Positioning System (GPS) units may be used while performing outdoor area field surveys. For example, during an outdoor gamma scan survey, a GPS unit will be carried adjacent to the gamma detector. The GPS output will be logged along with the gamma count rates, so that each gamma reading will have a location point associated with it. After the survey, gamma data may be color coded and plotted on a survey map.

In addition, outdoor survey units may be mapped by walking the perimeter with a GPS unit. Once the outline is digitized, static reading locations for that survey unit can be generated in latitude and longitude, using Visual Sample Plan (VSP) software (Gilbert et al., 2001). These points can be located using the GPS unit and then static readings and samples can be taken.

Although GPS cannot be used for indoor surveys, building locations will be recorded by taking GPS readings at the exterior building corners, taken from geospatially referenced aerial photographs, or found through other investigations or accepted land-surveying practices.

TABLE 8-1

DERIVED AIR CONCENTRATION

Radionuclide	Radiation	DAC (μCi/mL)	10% DAC (μCi/mL)
Radium (Ra)-226	Alpha (α)	3.0×10^{-10}	3.0×10^{-11}
Plutonium (Pu)-239		3.0×10^{-12}	3.0×10^{-13}
Thorium (Th)-232		5.0×10^{-13}	5.0×10^{-14}
Strontium (Sr)-90	Beta (β^-)	8.0×10^{-9}	8.0×10^{-10}
Tritium (H)-3		2.0×10^{-5}	2.0×10^{-6}
Cobalt (Co)-60	Beta/gamma (β^-, γ)	7.0×10^{-8}	7.0×10^{-9}
Uranium (U)-235		6.0×10^{-10}	6.0×10^{-11}
Cesium (Cs)-137		6.0×10^{-8}	6.0×10^{-9}
Americium (Am)-241	Alpha/gamma (α, γ)	3.0×10^{-12}	3.0×10^{-13}

Notes:

Types of radiation: α - alpha, γ - gamma, β^- - beta
μCi/mL – microcurie per milliliter
CFR – Code of Federal Regulations
DAC – derived air concentration (10 CFR 20 Appendix B)

9.0 DECONTAMINATION, DISMANTLING, AND DISPOSITION

Decontamination, dismantling, and disposition activities will be performed, as identified in a TSP, as part of remedial action activities performed at HPS to clean up areas contaminated by radiation. Decontamination is the removal, by chemical or physical means, of radioactive material from various types of internal and external surfaces including equipment, materials, components, systems, and structures. Dismantling is the removal, as applicable, of furniture, equipment, and walls or similar structural outworks and components for the purpose of permanently breaking down, removing, and eliminating such materials. This would also include conducting work in open land areas to support the removal of contaminated material or devices. In order to assess the extent and type of contaminants identified during the course of ongoing fieldwork, various remedial activity support surveys will be necessary.

9.1 DECONTAMINATION

To support ongoing work at HPS, decontamination of materials, equipment, and structures may be necessary. There are numerous decontamination methods available for use. If practical, manual decontamination methods should be used as a first alternative in decontaminating. Abrasive methods may need to be used if areas of fixed contamination are identified. Chemical decontamination can also be advantageous by using detergents for nonporous surfaces with contamination present. Chemicals should be selected that will minimize creating mixed waste.

Decontamination activities will be conducted using appropriate SOPs or TSPs.

9.2 DISMANTLING AND REMEDIATION

To support the release of buildings, structures, equipment, materials, and land areas, remedial support activities will need to be conducted. These activities include, but are not limited to, soil removal, and dismantling, disassembling, and/or removal of various systems, components, and structures. The following is a list of expected remedial support activities that may be performed at HPS:

- Piping and associated pumping system removal
- Ventilation system removal
- Equipment, furniture, and material removal
- Soil, asphalt, or concrete removal
- Building demolition
- Structure removal

Specific control methods and more detailed information will be provided in the TSP.

9.3 DISPOSITION

Disposition is the methodology of identifying the radiological status of equipment, materials, and structures for its end use. Disposition will be conducted after the decontamination and/or dismantling activities have been completed. This will include the following key elements:

- Control of equipment and materials
- Free release
- Decontaminate for free release
- Off-site disposal

Controlling equipment and materials is essential to ensure that contaminated items are not used in uncontrolled areas to prevent the inadvertent spread of contamination. If decontamination methods are unsuccessful, some materials and equipment may be stored for future use in radiologically controlled areas. If it is not feasible or cost-effective to control contaminated equipment and materials, they will be disposed of off site.

10.0 RADIOACTIVE MATERIALS MANAGEMENT

10.1 INTRODUCTION

Planned site activities are expected to involve the presence of radioactive materials. These activities will be conducted by trained and qualified personnel who are designated to apply management and control measures as regulated by the cognizant regulatory agencies.

A qualified license representative will delegate the daily operating responsibility for related activities with the use of defined directives that comply with the corresponding NRC materials license and other applicable regulatory requirements. Actions necessary to carry out related decisions and policy include:

- Specific oversight of radioactive materials that result from site activities
- Acting as a primary point of contact for site-specific activities involving radioactive materials
- Establishment of administrative controls to manage radioactive materials according to regulatory requirements
- Acting as a primary point of contact with the NRC or Agreement States on radioactive materials present such as point sources, soil contaminants, naturally occurring radioactive material, etc.
- Establishing, in the event of multiple material license use, an agreement between each license owner as to what tasks will be designated under each specific license, (including development of a document of "mutual agreement" — defining individual license responsibilities for which a copy of the final agreement will be made available for each licensee represented)

10.2 MANAGING RADIOACTIVE MATERIALS

The day-to-day management of radioactive material is governed by program criteria detailed in appropriate SOPs. This manual reflects applications and techniques unique to exposure reduction goals and control. Specific SOPs are designed to govern the acquisition, receipt, storage, distribution, and use of radioactive material.

Existing materials at HPS that require the implementation of radioactive materials management include:

- Sealed radioactive sources used for radiation-detection instrument checks
- The use of unsealed sources in laboratory analyses at HPS

- Devices and contaminants from past operations at HPS
- Control of radioactive and mixed waste generated during current site operations

Radioactive material will be managed by the RSO or designated appointee. Off-site organizations and contractors who plan to use radioactive materials in support of TtEC activities must obtain approval. Approval can be obtained by directing a request, in writing, through the RSO or designated appointee. Requests must include:

- A detailed description of proposed radioactive material use
- A copy of the appropriate NRC or Agreement State License with a completed NRC Form 241, Radioactive Material Permit or exemption
- Name and address of the responsible local representative and contact information
- A copy of contract documentation describing the work to be done and inclusive dates
- Documentation acknowledging that the RSO or designated appointee can perform periodic checks to ensure that the user is complying with the requirements of the Base-wide RCP

10.3 RADIOACTIVE MATERIAL HANDLING

There should be no contact with radioactive material or exposure to ionizing radiation where an expected benefit is not realized. Exposures should be ALARA and consistent with technology, cost, and operational requirements.

10.3.1 Limitations

Designees responsible for the control of radioactive materials are required to limit its accessibility and use. Material management policies (i.e., that performed by TtEC and its contractors and affiliates) require an inventory accountability process. Clearly defined radiological safety requirements have been established for 1) operating, changing, and repairing systems containing, or designed to operate with radioactive material; and 2) control of waste materials resulting from decontamination, dismantling, and remediation processes.

10.3.2 Authorizations

Work involving the handling and storage of radioactive materials at HPS will be performed under the specifications of the appropriate SOP, and with authorization for such work from the RSO and license representative.

10.4 RADIOACTIVE MATERIAL CONTROL

In order to minimize unauthorized access to, and/or removal from the site of radioactive material(s), application of appropriate security-protection measures will be exercised (i.e., combination and/or key lock safes for source storage, connex units with padlocked doors for sample storage, "clam shell" encasings for drums, etc.). Licensed radioactive sources and devices, as well as non-exempt quantities of radioactive materials in non-permitted sources, must be routinely inventoried and documented as such. Identification of locations where radioactive materials are present will be accomplished with the use of conspicuous posting compliant with Title 10 Code of Federal Regulations (CFR) Part 20.

The SOP will be periodically assessed for accuracy and applicability by the RSO or designated appointee (and in conjunction with the corresponding qualified License representative), to ensure that necessary requirements are in place to manage radioactive material. The degree of required management rules is dependent upon the quantity and type of material on hand, where the material is generated, and the location and configuration of available storage.

Only pre-authorized areas will be used to store radioactive materials at HPS. These areas will be selected with concurrence of RASO and the RPM. Security measures for these areas will be coordinated with the Caretaker Site Office (CSO).

Radioactive material handling activities must be performed in a manner to ensure that:

- Access to areas and/or rooms is restricted where radioactive materials are known to be present
- Surveys of areas where sealed radioactive materials are stored are completed at least weekly
- Surveys of areas where unsealed radioactive materials are used are completed according to an RWP
- Surveys of other radioactive materials storage areas are completed as defined by other HPS work documents

11.0 DOCUMENTATION AND RECORDS MANAGEMENT

The purpose of this section is to define standards for the maintenance and retention of radiological records. Radiological records provide historical data, document radiological conditions, and record personnel exposure.

Sample collection, field measurement, and laboratory data will, to the extent practicable, be recorded both electronically and on paper. Data and information recorded on paper will be recorded using indelible ink. Records of field-generated data will be reviewed by the RTM or a designee knowledgeable in the measurement method for completeness, consistency, and accuracy. Data manually transposed to paper from electronic data collection devices will be compared to the original data sets to ensure consistency and to resolve noted discrepancies. Electronic copies of original electronic data sets will be preserved on a non-magnetic retrievable data storage device. No data reduction, filtering, or manipulation will be performed on the original electronic versions of data sets.

Changes or corrections on project documentation will be made by crossing out the erroneous item with a single line, initialing (by the person performing the correction) and dating the correction. The original item, although erroneous, must remain legible beneath the cross-out line. The new information will be written above the crossed-out item. Corrections must be written clearly and legibly with indelible black or blue ink.

11.1 REQUIREMENTS

Records resulting from implementation of this Base-wide Plan shall meet the quality standards as outlined herein. All records must be retrievable and maintained for their prescribed retention time.

Completed records awaiting transfer to long-term storage shall be stored in an appropriate manner to minimize loss and damage that could result from exposure to weather, fire, or other conditions.

The signature and initials of all personnel who sign records shall be on file. This file shall be updated when a change in personnel is warranted.

Principal personnel who create, review, and approve radiological records must sign and date the record and follow quality standards specified in Section 13.

If working copies of records are used for reference, they will be stored separately from the original.

11.2 DOCUMENT QUALITY STANDARDS

Records shall be legible and completed with an indelible ink that provides reproducible and legible copies. Records shall be dated and contain a verifiable signature of the originator. Errors shall be corrected by marking a single line through the error and by initialing and dating the correction. Radiological records shall not be corrected using an opaque substance. Shorthand or nonstandardized terms may not be used.

To ensure traceability, each record shall clearly indicate:

- Identification of the facility
- Specific location
- Function and process
- Date
- Document number (if applicable)

The quantities used in records shall be clearly indicated in standard units (curie, rad, rem, dpm, Bq), including multiples and subdivisions of these units.

11.3 DOCUMENTATION

The four types of documentation that will be maintained and assessed are field operation records, laboratory records, data handling records, and work support documents.

11.3.1 Field Operation Records

The information contained in field operation records will document overall field operations and may consist of the following:

- Field measurement records – At a minimum, this documentation will identify the names of the persons conducting the activity, measurement identification, measurement locations, measurement results, maps and diagrams, equipment, and unusual observations. Data record forms and/or bound field notebooks will be used to record raw data and make references to prescribed procedures and changes in planned activities.
- Sample tracking records – At a minimum, these records will identify the samples, samplers, date of sampling, date of transfers, and receivers. Chain-of-custody (COC) forms will be used to document the progression of samples.
- QC records – QC records document the performance of QC practices in the field and include calibration and standards' traceability documentation that can be used to provide reproducible reference points to which similar measurements can be correlated. These records will contain information on the frequency, condition, level

of standards, and instrument calibration history. QC measurement records are more completely defined in Section 13.0 of this Base-wide Plan.

- Personnel files – Personnel files record the names and training certificates of the staff collecting the data and will be maintained in accordance with approved procedures.
- SOPs – SOPs describe the procedures used in the field to collect data and outline potential areas of difficulty in performing measurements.
- Deficiency and problem identification reports – These reports document problems and deficiencies encountered as well as suggestions for process improvement.
- Corrective action reports – Corrective action reports document what methods were used in cases where general field practices or other standard procedures were violated and include the methods used to resolve noncompliance.

11.3.2 Laboratory Records

Laboratory-specific records include, but are not limited to:

- Laboratory measurement results and sample data – Information contained in these records includes the number of samples, sample identification, requested analysis, sample measurement results, any deviations from the SOPs, time of day, and date. Laboratory notebooks shall be kept using good laboratory practices for all radiochemistry laboratories at HPS.
- Sample management records – These records contain sample management records, including COC records, document sample receipt, handling and storage, and scheduling of analysis. These records will verify that sample-tracking requirements were maintained, reflect discrepancies in the samples (e.g., receipt of damaged samples), and note proper log-in of samples into the laboratory.
- Analytical methods – This documentation includes sample preparation and analysis, instrument standardization, detection and reporting limits, and method-specific QC requirements. Documentation demonstrating laboratory proficiency with each method used may also be a part of the data-reporting package.
- QC records – This information includes the general QC records, such as initial demonstration of capability, instrument calibration, routine monitoring of analytical performance, and calibration verification considered in the selection of analytical laboratories.
- Deficiency and problem identification reports – These reports document problems and deficiencies encountered as well as suggestions for process improvement.
- Corrective action reports – These reports document the methods used to resolve noncompliance in cases where general laboratory practice or other standard procedures were violated.

11.3.3 Data Handling Records

Data-handling records document protocols used in data reduction, verification, and validation (as applicable). Data reduction involves data transformation processes such as converting raw data into reportable quantities and units, using significant figures, and calculating measurement uncertainties. Data verification involves reviewing reports of data entered into electronic data management systems by the appropriate supervisory personnel knowledgeable of and with access to the original data to verify data transcription accuracy in accordance with the approved SOP. Data comparison and evaluation will be done on radiological samples sent for off-site analysis, as discussed in the SAP (Appendix B). Record copies of surveys, sampling, and analytical data (and their supporting data) will be protected and maintained in project record files.

11.3.4 Work Support Documents

Work support documents will include, but not be limited to the following:

- RWPs – The RWP will provide a complete document addressing existing radiological conditions, work scope and limitations, radiological limitations, PPE requirements, dosimetry requirements, ALARA considerations, and specific instructions to personnel.
- Work Plans – Substantial deviations from the Base-wide Plan may result in the generation of a stand-alone, job-specific work plan. Where prepared, these stand-alone work plans would define a scope and purpose, and contain a series of steps to be carried out or goals to be accomplished.
- Task-specific Plans – These documents will be prepared for each survey and remediation performed under the Base-wide Plan. The TSPs will supplement the information provided in the Base-wide Plan, provide relevant location-specific data, and identify variances and/or additions to the Base-wide Plan.
- Reports – These documents, which record the pertinent field activities performed under a specific work plan or TSP, may include release criteria, objectives, survey results, instrumentation used, detection sensitivities, survey procedures, sample analyses and results, and conclusions. These reports may contain risk factors and dose assessments. Documentation will also include applicable survey data and other items specified in TSPs.

11.3.5 Preparation of Documents

Documents will be prepared using a standard form that has been verified as current and in good quality.

Documents will be prepared in accordance with the applicable guidance for the specific document, if any, and in accordance with the quality standards established in this Base-wide Plan.

Once a document has been created, reviewed, and signed, it is a completed radiological record. For inclusion in a final report, a supplemental record may be prepared. A supplemental record is a copy of the original record that does not contain strikeout/initials; technical errors or omissions that were corrected using strikeout/initials will not be included in the supplemental record. This supplemental record must maintain traceability to the original document.

11.3.6 Review of Documents

Completed documents will be reviewed for accuracy of calculations, legibility, proper units, proper forms, etc. Documentation addressing conclusions must be reviewed to ensure the conclusions drawn are supported by the data provided with the document. The document should meet all quality standards before it is submitted for final review and approval.

Supervisory reviews will be performed focusing on identification of trends, validity of recorded data and information, and identification of originators.

Subsequent quality reviews will be performed to verify that documents are complete, legible, and in compliance with the quality standards outlined herein.

11.3.7 Approval of Documents

In accordance with the QC procedures specified in Section 13.0, all documents will be reviewed to verify that they are correct and in compliance with the requirements of this Base-wide Plan prior to transmittal.

11.4 RECORD RETENTION

Radiological records including, but not limited to, logbooks, data sheets, electronic files, and reports will be retained by TtEC or by a TtEC record management contractor for a minimum of 30 years from the date of the generation of the record.

12.0 ENVIRONMENTAL PROTECTION PLAN

Radiological activities carried out at HPS under this Base-wide Plan are not expected to use and/or affect natural resources, impact traffic flow or access, generate noise that will require the use of hearing protection in the immediate area, generate dust, or result in liquid and/or airborne discharges outside the work areas that would require sampling actions. However, in the event that planned activities may affect these issues, applicable guidance from this section will be incorporated into the TSPs. This section presents information regarding the environmental management practices to be conducted under this Base-wide Plan. The purpose of this Environmental Protection Plan (EPP) is to detail the means of compliance with the applicable or relevant and appropriate environmental regulatory requirements during the radiological surveying, sampling, and D&D activities at HPS. This EPP will help ensure that activities associated with the environmental management program are conducted in a systematic and well-documented manner.

12.1 LAND RESOURCES AND VEGETATION

The geology at HPS consists of Franciscan Formation bedrock; unconsolidated deposits of sand, gravel, and clays; and artificial fill. The artificial fill is present in approximately 400 acres that were reclaimed from the Bay (NAVSEA, 2000) and filled on a level plane about 12 to 15 feet above mean sea level. Where activities occur outside of buildings, and/or equipment or debris is located outside of a building, precautions will be taken to ensure minimal impact to land resources and vegetation.

12.2 FISH AND WILDLIFE/THREATENED, ENDANGERED, AND SENSITIVE SPECIES

Physical structures, such as riprap and docks, serve as artificial habitats for estuarine life. Marine life has been disturbed as a result of activities in the Bay adjacent to HPS. Several hundred types of plants and animals, including the following, are believed to live at or near HPS: terrestrial and marine plants and algae; benthic and water column-dwelling marine animals such as clams, mussels, amphipods, and fish; insects; amphibians; reptiles; birds; and mammals (Levine-Fricke Recon, Inc., and PRC Environmental Management, 1997). No federally listed endangered or threatened species are known to permanently reside at HPS or the vicinity (Levine-Fricke Recon, Inc., and PRC Environmental Management, 1997); however, San Francisco Bay is a seasonal home to migrating fish and birds. Table 12-1 provides a listing of threatened and endangered species at or near HPS. Restricting vehicles and equipment to paved areas as much as possible will minimize disturbance of habitats.

12.3 WETLANDS AND STREAMS

Two freshwater streams, Yosemite and Islais Creeks, flow into San Francisco Bay adjacent to the border with HPS. Surface water resources at the site are limited to small groundwater seeps from exposed bedrock and the surface water in adjacent San Francisco Bay.

12.4 STORMWATER, SEDIMENT, AND EROSION CONTROL

12.4.1 Stormwater Pollution Prevention Plan

As required, a Stormwater Pollution Prevention Plan (SWPPP), which addresses installation and maintenance of appropriate Best Management Practices (BMPs) for controlling stormwater, will be prepared in accordance with the Stormwater Resources Control Board (SWRCB) requirements; however, a general National Pollutant Discharge Elimination System stormwater construction permit is not anticipated to be required. Appropriate radiological controls will be addressed in any SWPPP that includes intrusive activities in an impacted area.

12.4.2 Stockpile Control

Stockpiles will be stored in staging areas adjacent to the activity or in a designated area. Whenever possible, stockpiles will be located within the building the waste originated from. Stockpiles will be placed on a polyethylene liner. To provide dust control and prevent runoff, outdoor stockpiled material will be covered each night with 10-mil polyethylene liners. Stockpiles of radiologically contaminated materials will be secured when not attended.

12.4.3 Non-radiological Hazardous Materials

Releases to water and land will be prevented through the implementation of the BMPs presented in the *Erosion Control Field Manual* (Friends of the Estuary, 1998) and the *California Stormwater Best Management Practices Handbook* (Camp, Dresser, and McKee, 1993). Hazardous materials will be stored in a central area at least 100 feet from surface waters. Containers will be stored properly when not in use and will be placed in the appropriate storage cabinet or secondary containment structure to reduce the risks of fire and releases. In addition, refueling operations for construction equipment will be conducted in a designated area at least 100 feet from surface water bodies. Vehicle/equipment refueling operations will be supervised and appropriate spill-control equipment will be available on site in the event of a release. Proximal storm sewer inlets will also be covered during refueling or hazardous material transfer operations.

12.5 AIR QUALITY

The substantive requirements of the Bay Area Air Quality Management District (BAAQMD) rules relating to visible emissions, fugitive dust, and particulate matter emissions must be complied with; however, no permits are required. Fugitive dust emissions may occur during soil excavation and waste-handling activities. Appropriate actions will be taken to limit exposure to emissions such as wetting stockpiles and roadways, and covering stockpiles when not in use. Construction activities will comply with the substantive requirements of BAAQMD Rule 40 and regulations 6-305 and 8 pertaining to fugitive dust emissions and maintaining, covering, and stockpiling excavated soil. Dust will be controlled during excavation with water application. Ambient air monitoring will be performed upwind and downwind of the project area, as required, and the monitoring results will be used to determine if additional measures are required to control adverse impacts from airborne contaminants. Measures may include increased PPE levels for project personnel, reduction or stopping of excavation activities, and/or dust abatement using water application or by covering stockpiles with plastic sheets.

12.6 NOISE

Noise will be produced by heavy equipment used at the site during cleanup operations. However, the work area is not in the immediate vicinity of residential areas. Industrial tenants are present; however, noise levels are not expected to impact their operations. Therefore, noise is not expected to be a concern to surrounding populations.

12.7 CONSTRUCTION AREA DELINEATION

Prior to the commencement of activities within the individual buildings and/or open spaces, notices will be posted to indicate that access to the building will be restricted to only those personnel who are properly trained and have appropriate authorization to enter the delineated areas. Because other contractors may be conducting cleanup activities or monitoring in nearby areas, work areas will be defined and secured to prevent unauthorized entry. DON coordination will be required for work conducted in tenant-occupied spaces.

12.8 TRAFFIC CONTROL PLAN

This Traffic Control Plan provides guidelines and addresses measures for vehicular traffic control during activities at HPS.

12.8.1 Analysis of Potential Impacts

During implementation of this Base-wide Plan, HPS may host radiological activities that are traffic-related consisting of trucks delivering equipment and materials, personnel and support vehicles, and trucks transporting wastes off site. The project activities will require transportation

at various times, and therefore, the traffic will be assessed on a daily basis because the exact times of the slow traffic cannot be defined prior to the start of fieldwork. The project team will coordinate radiological activities that may generate traffic with the CSO and the ROICC in order to avoid conflicts with other activities being performed concurrently at HPS. A schedule of proposed traffic locations and times will be reviewed with the CSO and ROICC during the weekly Contractor Quality Control (CQC) meetings.

The delivery and transportation of equipment and materials will only be allowed between 0730 and 1700 hours (**no exemptions**) on normal business days. Trucks of various capacities, some that may exceed 20 tons, may be entering and exiting HPS. Projects may require permitted oversized vehicles for the transportation of heavy and extra-wide construction equipment. Truck staging will only be allowed inside HPS because no trucks will be allowed to idle along public streets outside the HPS boundary.

Because of the limited duration of most construction activities, the impacts to transportation and traffic patterns are expected to be insignificant. Heavy construction equipment such as front-end loaders, excavators, and other support vehicles will remain at the site for the duration of the field activities following initial mobilization. Equipment will not leave the site until such time as it is no longer needed.

12.8.2 Traffic Safety Measures

In order to expedite the passage of traffic through or around the work area and within HPS, TtEC will install and maintain the necessary signs, lights, temporary railings, barricades, and other facilities for the sole convenience and direction of facility personnel and tenant traffic, as well as to prevent potentially hazardous conditions from existing. If necessary, TtEC will furnish competent flaggers whose duties will be to direct the movement of facility traffic through or around the work area and to give adequate warning to facility personnel and tenants of dangerous conditions to be encountered.

Convenient access to driveways and around the work area will be maintained during construction activities. Water- and dust-abatement measures will be applied as necessary to the on-site roads used by construction vehicles for alleviation or prevention of dust nuisance.

No materials or equipment will be stored where they may interfere with the free and safe passage of facility personnel and tenants. At the end of each day's work and at other times when construction operations are suspended, TtEC will remove equipment and other obstructions from that portion of the roadway for use by facility and tenant traffic. In addition, TtEC will adhere to facility speed limit requirements.

12.8.3 Traffic Controls

Traffic controls will be used to provide for the efficient completion of work activities in a safe working environment while minimizing the impact to the normal traffic flow. Traffic controls will be required during removal activities in the excavation and stockpile areas to allow for equipment operation and truck loading for off-site transportation. Traffic controls may include, but will not be limited to, the following:

- Traffic flow will be maintained during construction activities on through roads.
- Loading and transportation of wastes will be scheduled during off-peak hours to minimize disruptions to facility traffic.
- Transportation demand management strategies, such as using carpools or vanpools for construction workers, will be encouraged.
- End dumps and other transportation trucks removing debris from HPS will be scheduled to avoid queuing along major streets. Close coordination between the TtEC Construction Manager, Equipment Manager (or designee), and the truck dispatcher will be maintained during loading and unloading activities.
- A sufficient area for parking will be provided to passenger vehicles and haul trucks in the support area.
- Cones, flags, signs, and other traffic-control measures will be used, as needed, to facilitate loading and unloading.

In order to prevent congestion of site access roads during loading and hauling operations, no trucks will be allowed to queue along any street. On-street parking will be prohibited for vehicles associated with the construction activities in order to maintain normal access and clear lanes. During non-construction periods, non-applicable signs will be covered with black plastic or temporarily removed.

Other project-specific measures will be used to minimize the impacts of the proposed construction activities. These measures include the following:

- Proper design geometrics will be applied at access driveways and internal streets to accommodate trucks and fire apparatuses.
- Clear access points for trucks will be maintained at the project entrance to allow for efficient movement of construction-related traffic and expedite the entry and exit of construction vehicles in and out of the site.
- An adequate turning radius will be provided in work areas, including loading areas near the stockpiles.
- Sufficient area will be provided for parking vehicles on site during construction, including space for haul trucks.

- Close coordination will be maintained between the DON and other facility contractors to ensure safety and to minimize impacts to other activities within HPS.

Traffic control activities will conform to the applicable specifications of the *State of California Manual of Traffic Controls for Construction and Maintenance Work Zones* (California Department of Transportation [Caltrans], 1996] and will be approved by the DON.

12.9 GENERAL OPERATIONS

In accordance with TtEC procedures, the Construction Manager or designee will conduct weekly inspections. These inspections will be documented and will include the project areas and waste-storage locations. The project area and waste-storage locations will also be inspected during and after major storms to identify and respond to potential releases or sedimentation problems.

12.10 SPILL PREVENTION, RESPONSE, AND REPORTING

12.10.1 Spill Prevention

The primary activities that may result in a spill include vehicle fueling and management of decontamination waste. Spill-prevention practices for these activities are as follows:

- **Fueling** – Vehicles will be fueled and serviced prior to moving onto the site. On-site fueling of equipment will be conducted within a designated area. No bulk quantities of fuel will be stored on site.
- **Wastewater** – Wastewater will be stored in temporary tanks or 55-gallon drums within a secondary containment area. Therefore, spills from the containers or tanks will be contained and will not be released into the surrounding areas.

12.10.2 Spill Response

In the event of a release of hazardous materials into the environment, according to the SHSP, TtEC will contain or control the release or evacuate the area if the spill is significant or represents an immediate health threat. Spills, leaks, and fires at HPS must be reported to the RPM, ROICC, and CSO. In addition, all spills involving radioactive material or that occur at a radiologically impacted site must be reported to the RSO and RASO. Absorbent pads, shovels, and 55-gallon drums will be kept on site to address the possibility of spills.

12.10.3 Spill/Release Reporting

The steps below outline the chain of communications that will be followed if a spill of a hazardous substance occurs. A significant spill will be considered any spill over the reportable quantity, as determinable by federal and/or state regulations, as well as any spill below the reportable quantity that is not properly contained causing a release into the environment.

- Site personnel involved in the spill will immediately contact the TtEC Spill/Release On-Site Coordinator, Construction Manager or SHSS, who will notify the PjM or designee. The three following individuals or their designees will be on site during radiological field activities:

RSO	Daryl Delong
SHSS:	To Be Determined
Construction Manager:	Gary Clark

The TtEC SHSS or Construction Manager will contact the DON RPM, ROICC, CSO, and RASO individuals identified below:

DON RPM:	Ralph Pearce (619) 532-0912
ROICC:	Peter Stroganoff (510) 749-5941
CSO:	Mike Mentink (415) 743-4729
RASO	Laurie Lowman (757) 887-4692

- If a release of a waste or hazardous substance, regardless of quantity, could threaten human health or the environment outside the facility, the PjM, or his designee, will verify that the National Response Center (800-424-8802) and the local Emergency Response Coordinator (Fire Department) have been notified by the DON. Releases will be reported and written emergency notices will be submitted under the SARA, Title II requirements.
- In concert with the above actions, the following persons will be contacted by the PjM or Superintendent:

TtEC Regulatory Compliance Specialist:	Greta Neuman Office: (757) 963-1670 Cell: (757) 619-4291
TtEC CIH:	Roger Margotto Office: (619) 471-3503 Cellular: (949) 306-2517

In the event of a spill of radioactive material, the radiological subcontractor will make appropriate notifications in accordance with its NRC license requirements. Notifications will also include the DON RPM, RASO, and TtEC RSO.

12.11 PERSONNEL TRAINING/CERTIFICATION REQUIREMENTS

The following training and certification requirements will apply:

- Site personnel must have current OSHA Health and Safety/Emergency Response Hazard Communication and Resource Conservation and Recovery Act training.
- Field personnel will receive radiation awareness training.
- Site personnel performing non-radiological waste management functions must be trained, or under the supervision of an individual trained, in accordance with EPP requirements. Subcontractors performing waste management functions must supply proof of training.
- Site personnel performing U.S. Department of Transportation (DOT) functions, such as selecting, packaging, marking, labeling, preparing shipping papers, and loading non-radiological wastes, must be trained or under the supervision of an individual trained in accordance with DOT requirements. Subcontractors performing DOT functions must supply proof of training.

12.12 UPDATING THE EPP

This EPP will be updated as needed to reflect changing site conditions.

TABLE 12-1

THREATENED/ENDANGERED SPECIES AT HUNTERS POINT SHIPYARD

Species	Common Name	Status at HPS	Designation
Onchorhynchus tshawytscha	Chinook salmon	Observed	SSC, SE, FT
Gavia immer	Common loon	Observed	SSC
Pelecanus erythrorhychos	American white pelican	May be present	SSC
Pelecanus occidentalis californicus	California brown pelican	Observed	SE, FE
Phalacrocorax auritus	Double crested cormorant	Observed	SSC
Bucephala islandica	Barrow's goldeneye	Observed	SSC
Charadrius alexandrinus	Snowy plover	May be present	SSC
Numenius madagascariensis	Long-billed curlew	Observed	SSC
Larus californicus	California gull	Observed	SSC
Sterna caspia	Caspian tern	May be present	SSC
Sterna elegans	Elegant tern	May be present	SSC
Circus cyaneus	Northern harrier	May be present	SSC
Pandion halieatus	Osprey	Observed	SSC
Falco peregrinus	Peregrine falcon	Observed	SE, FE
Asio flammeus	Short-eared owl	May be present	SSC
Athene cunicularia	Burrowing owl	Observed	SSC
Eremophila alpestris	Horned lark	May be present	SSC
Lanius ludovicianus	Loggerhead shrike	Observed	SSC
Geothlypis trichas	Common yellowthroat	May be present	SSC
Melospiza melodia	Song sparrow	May be present	SSC

Notes:

Designation Codes:
SSC – California Department of Fish and Game Species of Special Concern
SE – Listed as endangered by the State of California
FE – Listed as endangered by the federal government
FT – Listed as threatened by the federal government
HPS – Hunters Point Shipyard

13.0 QUALITY ASSURANCE/ QUALITY CONTROL

This section establishes the general procedures and methods for field inspections of the radiological activities performed base-wide. This plan also describes the actions that will be taken to ensure that the QC system remains effective for its intended use. This plan will be supplemented as necessary with additional requirements detailed in the TSPs. This plan combines the NFECSW Remedial Action Contract No. N68711-98-D-5713 requirements with the established QC system criteria specified in applicable SOPs and the TtFW Final CQC Program Plan (TtFW, 2004b).

13.1 ORGANIZATION AND RESPONSIBILITIES

The organization and authority for project personnel performing radiological and construction operations, including subcontractors, is defined in Section 3.0 of this Base-wide Plan.

13.2 SUBMITTALS

Section 11.0 describes the documentation expected to be produced and the assessment requirements for the activities performed under this Base-wide Plan. Section 11.0 also defines the review and approval process of data and reports. In addition, TtEC will institute and maintain a Submittal Register to track submittals from issuance to approval. A list of submittals will be developed prior to the initiation of project activities and will be revised as necessary. Submittals will be scheduled, reviewed, certified, and managed.

13.2.1 Submittal Requirements

The following requirements apply to submittals:

- Each submittal will be complete and in sufficient detail to allow determination of contract compliance.
- The PQCM will check items prior to submittal.
- A transmittal form certifying compliance with all contract requirements will accompany each submittal.
- Proposed deviation from the contract requirements will be clearly identified.
- Submittals will include items such as applicable drawings, descriptive literature, test reports, samples, operations and maintenance manuals, certifications, and warranties.

13.2.2 Review of Submittals

Submittals will be reviewed to ensure completeness, accuracy, and contract compliance. Submittal of a certification will be reviewed by appropriate technical disciplines and approved by the PQCM for conformance to the project specifications or certification criteria. If technical in nature, the PQCM will ensure that the document has received a thorough review by a technically qualified individual. Reviewers must possess sufficient experience and/or education to have produced the original document. Prior to acceptance, submittals requiring modifications or changes will be returned to the originating organization for correction and then resubmitted for review and approval by the PQCM, or designee, prior to acceptance. Approved submittals will be stamped, signed, or initialed and dated. During the preparatory phase, the PQCM or designee will ensure that required materials and equipment have been tested and approved, prior to the start of field activities that require those items or materials. A submittal log will be maintained to indicate the status of submittals, which require DON review and approval and will be transmitted in accordance with the project distribution schedule. Submittals sent to the DON will use a transmittal form that will indicate each item transmitted, the date reviewed by the PQCM, and its review status. Upon completion of review, the DON will either return the transmittal sheet to the PQCM for further action, or accept the submittal as complete.

13.2.3 Submittal Process

Submittals will be provided to the DON and project personnel as determined by the distribution schedule. Each submittal will have a unique document control number. Submittal distribution will be scheduled in a manner to allow for sufficient review and approval time. Certain submittals may require accelerated processing to support DON objectives. However, in no case will the schedule take precedence over the production of a high-quality document.

A transmittal form will accompany each submittal. Each transmittal will be identified with:

- The Contract and Contract Task Order (CTO) number
- Name and address of the submitting organization
- Date of the submittal
- Description of the item being submitted, including reference to the applicable specification section
- Approval of the submitting organization indicating conformance to the requirements

13.2.4 Revised Submittals

Revised submittals will be logged, reviewed, and processed in a manner consistent with the initial submittal.

13.3 TESTING/VERIFICATIONS

The PQCM will verify the performance of tests specified or required by the TSPs to assure that control measures are adequate to provide a product conforming to contract specifications. The PQCM or designee is responsible for verifying the completion of related tests. These tests include both operational and/or and acceptance testing as appropriate.

13.4 DOCUMENTATION

Verification/test results and associated field documentation, both passing and failing, will be recorded on the CQC Report and submitted to the RPM and ROICC/NTR.

13.5 FIELD INSPECTION PLAN

A DFW matrix will be used to delineate specific field activities, including those of subcontractors and suppliers, the inspection process, and the required meetings to ensure compliance with the contract. The DFWs establish the measures required to verify both the quality of work performed and compliance with specified requirements, and include inspecting materials and workmanship before, during, and after each DFW. The DFWs for work governed by this plan may either be prepared as generic DFWs for repetitive activities or may be task-specific and attached to the applicable TSP. General descriptions of inspection attributes and the required phases of control will be presented in a DFW prepared for the specific activity.

The controls defined will be adequate to cover planned operations and are keyed to the proposed sequence of activities. Project QC includes implementing the following three control phases for the required aspects of the work specified in each DFW:

- Preparatory phase
- Initial phase
- Follow-up phase

13.6 QC MEETINGS

After the start of field activities, the PQCM will conduct DON and Contractor QC meetings at a frequency of once per week or as required by the ROICC/Navy Technical Representative (NTR). The meetings will be held at the project site. Attendees include but are not limited to the ROICC/NTR, RASO, the CSO, QAO, PjM, PQCM, RSO, and the SHSS. The following will be discussed at each meeting:

- Review the minutes of the previous meeting.
- Review the schedule.
  - Activities or testing accomplished since last meeting
  - Rework items identified since last meeting
  - Rework items completed since last meeting
- Review the status of submittals.
  - Submittals reviewed and approved since last meeting
  - Submittals required in the near future
- Review the work to be accomplished in the following two weeks and documentation required. Schedule the three phases of control and testing and establish:
  - Completion date for rework items
  - Required preparatory phase inspections
  - Required initial phase inspections
  - Required follow-up phase inspections
  - Required testing
  - Status of off-site work or testing
  - Required documentation
- Resolve QC and production concerns or issues.
- Address items that may require revisions to the Project CQC Plan.

13.7 PREPARATORY PHASE INSPECTION

The PQCM will conduct preparatory phase inspections prior to starting the DFWs associated with a TSP. These inspections will include:

- Reviewing this Base-wide Plan, associated TSPs, and attachments
- Ensuring that materials, items, and/or equipment have been tested, submitted, and approved
- Ensuring that provisions have been made to provide required control inspection and testing
- Examining the work area to ensure that required preliminary tasks have been completed and are in compliance with the approved requirements
- Conducting a physical examination of the required materials and equipment to ensure that they have been delivered to the site, conform to approved shop drawings or specifications, and are properly stored
- Reviewing the appropriate activity hazard analysis to ensure that safety requirements are met

- Discussing procedures applicable to the work
- Ensuring that the TSP for the work to be performed has been accepted by the DON

The PjM, RPM, ROICC/NTR, RASO, and the CSO will be notified at least two working days in advance of preparatory phase activity. This phase will include a meeting conducted by the PQCM and attended by the Construction Manager and the RSO, along with any other personnel involved in performing the DFW.

The issues discussed during the preparatory phase meetings will be documented on a Preparatory Inspection Checklist. The PQCM will direct personnel performing work activities as to the acceptable level of workmanship required.

13.8 INITIAL PHASE INSPECTION

An initial inspection will be performed at the beginning of field activities defined in the TSP and will include:

- A check of preliminary work to ensure that it is in compliance with requirements
- A review of the Inspection Checklist documenting results of the preparatory meeting
- Verification of full contract compliance, including required control, inspection, and testing
- Establishment of the required level of workmanship, and verification to ensure work meets minimum acceptable standards
- A check of safety requirements to ensure compliance with the applicable activity hazard analysis and BHASP

The PQCM will document initial inspections for each item using an Initial Inspection Checklist and attach it to the Daily QC Report. The exact location of the initial phase inspection will be documented.

13.9 FOLLOW-UP PHASE INSPECTION

During the completion of a particular work feature, follow-up inspections will be conducted to ensure continued compliance with requirements. The frequency of the follow-up inspections will depend on the extent of the work being performed. Follow-up inspections will be documented on a Follow-Up Inspection Checklist that will be attached to the Daily QC Report. A final follow-up check will be conducted on any completed work phase prior to the commencement of a subsequent phase. Any deficiencies will be corrected prior to starting additional phases of work or will be identified on a list of items that do not conform to the specified requirements or are incomplete.

13.10 ADDITIONAL PREPARATORY AND INITIAL PHASES

The PQCM may conduct additional preparatory and initial inspections on the same DFWs under the following circumstances:

- If the quality of ongoing work is unacceptable as determined by the PQCM, PjM, RPM, QAO, ROICC/NTR, RASO, RSO, or CSO
- If there are substantial changes in the staff, on-site supervision, or work crew
- If work on a DFW is resumed after a substantial period of inactivity
- If other problems develop
- Prior to restarting an activity following a Stop Work Order

13.11 COMPLETION INSPECTION

Completion inspections will be performed as summarized in this section.

13.11.1 Field Quality Control Completion Inspections

The PQCM or designee will conduct a preliminary inspection prior to the pre-final inspection, when all of the work or an increment of work is deemed to be substantially complete. The work will be inspected for conformance to plans, TSP specifications, quality, and completeness. The PQCM will prepare a rework items list of work not properly completed or work that does not conform to plans and specifications. The list will be included in the QC documentation and submitted to the PjM following the inspection and will specify an estimated date for correction of each deficiency. The completion inspection will be documented on the Completion Inspection Checklist and attached to the Daily QC Report.

13.11.2 Pre-final Inspection

The PjM will conduct the pre-final inspection. The RPM, ROICC/NTR, RASO, CSO, PQCM, and other primary management representative(s), as applicable, will attend. The PjM will schedule the pre-final inspection in response to notification from the PQCM prior to the planned inspection date. The PQCM is required to verify at this time that all specific items previously identified as being unacceptable, along with all remaining project work, will be complete and acceptable by the scheduled date for the pre-final inspection. At this inspection, the ROICC/NTR and the RASO will meet and develop a list of incomplete and/or unacceptable work performed under the contract and will provide this list to the TtEC site management team.

13.11.3 Final Acceptance Inspection

The PjM will schedule the final acceptance inspection based on notification from the PQCM of readiness. The RPM, ROICC/NTR, RASO, CSO, PQCM, and other primary management

representative(s), as applicable, will be invited. Notification will be provided prior to the planned final acceptance inspection date and must include verification that all specific items previously identified as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection.

13.11.4 Inspection Documentation

The PQCM is responsible for the maintenance of the inspection records, which will be legible and clearly provide all necessary information to verify that the items or activities inspected conform to the specified requirements, or in the case of nonconforming conditions, provide evidence that the conditions were brought into conformance or otherwise accepted by the ROICC/NTR and RASO. All inspection records will be made available to the DON, including RASO.

13.12 DOCUMENTATION

Preparation, review, approval, and issuance of documents affecting quality will be controlled to the extent necessary to determine that the documents meet specified requirements. Project documents that may be controlled include but are not limited to:

- Meeting minutes, conference notes, and confirmation notes
- Submittal Register
- Submittal Log
- Inspection documentation
- Contractor Production Report
- Daily CQC Report
- Radiological Logs
- Testing Plan and Log
- NCRs
- NCR Log
- Design Change Notices
- FCRs
- Rework Items List
- Project Plans including task-specific attachments
- COC
- RWPs

- Laboratory documentation
- Drawings

13.13 QUALITY CONTROL DAILY REPORT

The PQCM is responsible for maintenance of current records of QC operations, activities, and tests performed, including the work of subcontractors and suppliers. The records will include factual evidence that required QC activities and tests were performed. A Daily QC Report will be completed by the PQCM to document construction activities. A Contractor Production Report will also be completed daily by the Site Superintendent. These documents will include:

- Contractor/subcontractor(s) and their area of responsibility
- Operating equipment, with hours worked, idle, or down for repair
- Work performed that day, giving location, description, and by whom
- Test and/or control activities performed with results and references to specifications/ plan requirements, including the control phase (preparatory, initial, follow-up) and deficiencies (along with corrective action)
- Material received, with statement as to its acceptability and storage
- Submittals reviewed, with contract reference, by whom, and action taken
- Off-site surveillance activities, including actions taken
- Job safety evaluations stating what was checked, results, and instructions or corrective actions
- A list of instructions given/received and conflicts in plans and/or specifications
- Contractor's verification statement
- Site visitors/purpose, deviations from plans, difficulties, and resolution

The records will indicate a description of trades working on the project, the number of personnel working, weather conditions encountered, and any delays encountered. Both conforming and nonconforming features will be covered with a statement that equipment and materials incorporated in the work and workmanship comply with the contract. The original of this report will be furnished to the ROICC/NTR by 10:00 a.m. on the first work day following the date covered by the report. Reports need not be submitted for days during which no work is performed. At a minimum, one report will be prepared and submitted for every 7 days of no work and on the last day of a no-work period. All calendar days will be accounted for throughout the life of the contract. The first report following a day of no work will summarize work for that day only. Reports will be signed and dated by the PQCM and other appropriate personnel, including subcontractors responsible for completion of activities.

13.14 CONFERENCE NOTES AND CONFIRMATION NOTES

Notes will be taken and prepared for meetings and conferences when directed by the RPM. Conference notes will be typed and the original report furnished to the DON within 5 days after the date of the conference for concurrence and subsequent distribution to all attendees. At a minimum, this report will include:

- Date and place the conference was held
- List of attendees, including name, organization, and telephone number
- Written comments presented by attendees attached to each report with the conference action noted: "A" for an approved comment, "D" for a disapproved comment, "W" for a comment that has been withdrawn, and "E" for a comment that has an exception noted
- Comments made during the conference and decisions affecting criteria changes
- Conference notes that augment the written comments

The PjM is also responsible for providing a record of discussions, verbal directions, telephone conversations, and so forth in which TtEC personnel or their representatives participate on matters relating to this contract and work. These records, entitled "Confirmation Notices," will be numbered sequentially and will fully identify participating personnel, subject discussed, and any conclusions reached. The PjM, or his designee, will forward a reproducible copy of the confirmation notices to the RPM, RASO, and ROICC/NTR within 5 working days.

13.15 NONCONFORMANCES

The PQCM documents any work or materials not conforming to the technical specifications or project/contract requirements on an NCR, which will detail the nonconforming condition, the recommended corrective action(s), and the disposition of the corrective action(s). Qualified representatives from engineering, quality assurance and construction will review the NCR and either accept or reject the recommended corrective action or disposition. The NCR will remain open until the nonconforming condition has been satisfactorily resolved and verified by PQCM. Upon receipt of notification of detected nonconformance, NCRs for each item will be completed, and the ROICC/NTR and RASO will be notified of the condition and proposed corrective actions.

13.15.1 In-process Deficiencies

In-process deficiencies are those conditions discovered during the course of QC inspections that are intended to be corrected or brought into conformance with established acceptance criteria or requirements. In-process deficiencies will be noted briefly on the Daily QC Report and detailed

on the "Rework Items List." Items on this list that cannot be corrected will be considered as installed deficiencies and dispositioned as "use as is."

13.15.2 Installed Deficiencies

Installed deficiencies are those conditions discovered during the course of QC inspection of completed work that do not meet established acceptance criteria or requirements, and are not intended to or cannot be brought into conformance. These conditions will be noted on a Rework Items List in addition to an NCR for evaluation and disposition. The PQCM will issue the report summarizing the discrepancies.

In the event that the deficiency is not resolved within 30 calendar days after issuance of the NCR, a notice of non-response will be issued to the PjM. Each report will be consecutively numbered, logged, and updated by the PQCM. Resolution of installed deficient conditions will be approved by the PjM. Copies of completed reports will be sent to the ROICC/NTR.

13.15.3 Condition Requiring Stop Work

If corrective actions are insufficient, resolution cannot be reached, or results of prior work are indeterminate, work may be stopped. A Stop Work Order can only be issued by the PjM and the PQCM in writing or by the RASO/DON. If there is a disagreement between the PQCM and the PjM, the difference will be brought to the attention of the appropriate program level manager for resolution.

The condition(s) of the Stop Work Order will be described in detail on a Stop Work Memo in addition to referencing the Deficiency Report, which describes the condition(s), and to allow evaluation of the problem(s) and proper corrective action(s). Work will not continue until the conditions that prompted the Stop Work Order are corrected, verified, and approved by the PjM and PQCM. In accordance with 10 CFR 20, the RTMs and/or RSO have stop work authority for radiological activities when they observe a breach of radiological controls due to poor work practices, systemic failure, or acts of nature. If it should be necessary to issue a formal Stop Work Order, the RSO or RTM will process them through the PjM and PQCM.

13.15.4 Nonconforming Items

The nonconforming items will be controlled to prevent inadvertent use. All items noted as nonconforming will be clearly identified and when practical segregated from acceptable items.

13.15.5 Disposition

The disposition of NCRs will include the necessary actions required to bring the nonconforming condition to an acceptable condition and may include reworking, replacing, retesting, or

reinspecting. Implementation of the disposition may be done in accordance with the original procedural requirements, a specific instruction, or an FCR.

13.15.6 Field Change Requests and Design Change Notices

With the exception of the Sampling and Analysis Plan, site personnel will document changes to the approved plans in the field through the FCR form. (Changes to the Sampling and Analysis Plan will be done in accordance with Environmental Work Instruction #2 under TtEC's contract with the DON, and in consultation with the RASO and RSO.) At a minimum, the following information will be documented in the FCR form:

- Project name
- CTO number
- FCR number
- Documents to which a change is requested (including revision number if applicable)
- Description of the item or condition for which the change is requested
- Reason for the change
- Recommended disposition
- Cost and schedule implication of the change, if any
- Approval of disciplines, as required
- Approval of the PjM, Construction Manager, Program Environmental Safety Manager, QCM, and RASO

13.16 CORRECTIVE ACTIONS

On detection of a non-conforming condition, the Construction Manager will immediately take corrective action. In addition to resolving identified non-conforming conditions, corrective action records will also address the initial cause of adverse conditions and establish methods and controls to prevent recurrence of the same or similar types of non-conformances. The PQCM will monitor the corrective actions to verify that they were properly implemented and accepted and that the NCR was closed out.

13.17 QUALITY MANAGEMENT

In addition to the required QC field inspections, the TtEC Quality Program requires a Quality Management overview of the site quality assurance/QC Program implementation. The PQCM will perform regular internal QC checks on the site implementation of the quality assurance/QC Program. Reports of any deficiencies will be reported to the PjM for corrective action.

Inspections will be performed and checked for the following:

- Possession and use of approved procedures, standards, and project specifications
- Conformance with appropriate procedures, standards, and instructions
- Thoroughness of performance
- Identification and completeness of documentation generated during performance

14.0 REFERENCES

Abelquist, 2001. *Decommissioning Health Physics: A Handbook for MARSSIM.* Bristol, England: Institute of Physics Publishing.

American Society for Testing and Materials. 1998. Use of Portable Radiological Survey Instruments for Performing In Situ Radiological Assessments in Support of Decommissioning.

Atomic Energy Commission (AEC). 1974. *Regulatory Guide 1.86.* Termination of Operating Licenses for Nuclear Reactors. June.

California Department of Transportation (Caltrans). 1996. *State of California Manual of Traffic Controls for Construction and Maintenance Work Zones.*

Camp, Dresser, and McKee. 1993. *California Stormwater Best Management Practices Handbook.*

Department of Defense (DoD), Department of Energy, NRC, and U.S. Environmental Protection Agency (EPA). 2000. *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*, NUREG-1575, Revision 1. August.

Department of the Navy (DON). 2006. *Final Basewide Radiological Removal Action, Action Memorandum-Revision 2006, Hunters Point Shipyard, San Francisco, California.*

Friends of the Estuary. 1998. *Erosion Control Field Manual.*

Gilbert, R.O., J.R. Davidson, J.E. Wilson, and B.A. Pulsipher. 2001. *Visual Sample Plan (VSP) Models and Code Verification.* PNNL-13450, Pacific Northwest National Laboratory, Richland, Washington.

Grove Engineering. 1996. MicroShield™ Version 5.05 software. Grove Engineering: Rockville, Maryland.

International Organization for Standardization (ISO). 1988. *Evaluation of Surface Contamination – Part 1: Beta-emitters (Maximum Beta Energy Greater than 0,15 MeV) and Alpha-emitters.* ISO 7503-1, International Organization for Standardization, Geneva, Switzerland.

Levine-Fricke Recon, Inc., and PRC Environmental Management. 1997. *Parcel D Feasibility Study Draft Final Report.*

Naval Sea Systems Command (NAVSEA). 2000. *Historical Radiological Assessment, Hunters Point Annex, Volume I, Naval Nuclear Propulsion Program, 1966-1995.* August.

_____. 2004. *Historical Radiological Assessment, Hunters Point Annex, Volume II, History of the Uses of General Radioactive Material 1939-2003.* August.

Nuclear Regulatory Commission (NRC). 1997a. *Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions Guide.* NUREG-1507, U.S. Nuclear Regulatory Commission: Washington, DC.

_____. 1997b. *A Nonparametric Statistical Methodology for the Design and Analysis of Final Status Decommissioning Surveys* (Draft Report for Comment); NUREG-1505; Nuclear Regulatory Commission: Washington, DC.

Tetra Tech FW, Inc. (TtFW).*Hunters Point Shipyard Base-wide Radiological Control Plan* (RCP). 2004a.

_____. 2004b. *Final Contractor Quality Control Program Plan.*

U.S. Environmental Protection Agency (EPA). 1994. *Statistical Methods for Evaluating the Attainment of Cleanup Standards, Volume 3: Reference Based Standards for Soils and Solid Media.* EPA 230-R-94-004, EPA, Office of Policy, Planning, and Evaluation, Washington, D.C.

_____. 2000. *Radionuclides Notice of Data Availability Technical Document.*

APPENDIX A

EXAMPLE RADIATION WORK PERMIT

RADIATION WORK PERMIT (RWP)

RWP #: **2004-001 (HPS-Misc S & C -Routine, General)** Regular **X** Extended ____

SECTION I

Contract # **CTO No. 0072**	Date: **05/20/04**	Time: **1200 hrs.**

Location/Project: **Hunters Point Shipyard / Misc Surveillance & Control, Non-Intrusive and/or Non-RAD, Routine Ops**

Exposure Category: **D&D** Source Transfer Waste Processing Characterization

Job Description: **Field support (including routine surveillance) not designated as "RWP /Job Specific" and in areas suspected to require radiological controls.**

Estimated Start Date: **05/20/04** Estimated End Date: **12/31/04** Rev.: **0**

SECTION II

Existing Radiological Conditions:

Radiation Survey #: **HPS 2004 Series** Airborne Survey #: **N/A** Contamination Survey #: **HPS 2004 Series**

Existing General Area Radiation Level(s):	Existing **General** Contamination Levels:	Airborne DAC Level(s):
<1 mR/hr/γ		**N/A** % P
<1 mrad/hr/corrected β	***See "Remarks"** dpm/100cm^2 α	**N/A** % P
N/A mrem/hr/η	***See "Remarks"** dpm/100cm^2 βγ	**N/A** % H_3
Existing Maximum Radiation Level(s):	Existing Maximum Contamination Level(s)	Hot Particle?
<1 mR/hr/γ		
<1 mrad/hr/corrected β	***See "Remarks"** dpm/100cm^2 α	Yes
N/A mrem/hr/η	***See "Remarks"** dpm/100cm^2 βγ	**No**

Remarks:
***Reference survey / log report corresponding to site location in question (Contact: RTM or designee). "Existing" / "Maximum" contamination levels for accessible areas approved under this RWP: <1000 dpm/100cm2 βγ and < 20 dpm/100cm2 α. Posted "Contaminated Area" access prohibited**.**
**** Beyond initial RCT discovery and associated posting / set up**.

SECTION III

Radiological Limits:
Maximum Allowed WB Exposure Rate : **<1** mr/hr γ or mrem/hr η
Corrected : **N/A** mrad/hr Maximum Extremity Exposure Rate: **N/A** mr/hr
Maximum Allowed Contamination Level : **<20** dpm/100cm^2 α : **< 1000** dpm/100cm^2 βγ
Maximum Allowed Airborne Concentration Level: **N/A** % DAC
Remarks: **RCA requirements for access to a posted "Contaminated Area" shall be completed under the directives of a separate "job specific" RWP (unique to the assigned task / activity).**

Industrial Hygiene/Safety Concerns: **Job Specific: The SHSS, or designee, shall be briefed on planned activities prior to approved RWP work coverage. Using information gathered from the brief, the SHSS, or designee, shall then address any industrial hygeine/safety concerns associated with the stated task(s) and unique to the area of concern.**

RADIATION WORK PERMIT (RWP)

RWP #: **2004-001 (HPS-Misc S & C -Routine, General)** Regular __X__ Extended ____

SECTION IV

WORKER REQUIREMENTS

CLOTHING:	DOSIMETRY:	INSTRUCTIONS:	RESPIRATORY:
☐ Coveralls ☐ Lab Coat ☐ Cloth Hood X Paper Coveralls* ☐ Plastic Suit X Plastic Booties* X Rubber Shoe Covers* ☐ Canvas Shoe Covers X Cotton Liners* ☐ Rubber Gloves X Nitrile Gloves* X Safety Glasses/Face Shield* ☐ Extra ☐ Other Clothing Stay Time (Heat Stress, Radiaton, Exposure Limits, etc.): __N/A__ hrs.	X TLD* ☐ Film Badge ☐ SRD ☐ Standard ☐ Elbows ☐ Gonad Pack ☐ Hot Cell Entry ☐ Extremity ☐ Head Pack ☐ Special ☐ Knees ☐ Varying Field ☐ Upper Field ☐ Ground Field ☐ Alarming Dosimetry ☐ None	☐ Contact HP for Line Breaks X Protect Cuts* X **Pre-Job Briefing** X **Post-Job Briefing** X **Contact RTM, or Designee, Prior to Work in New Areas** ☐ Modesty Required X **Site Specific Instructions** ☐ Equipment Monitor at Job End X **Clean Up Work Area During and After Job** X **Eating, Drinking, Smoking,Chewing Prohibited** X Frisk Upon Exiting Contaminated Area* X **Have Prescribed RTS/RCT Coverage or Stop Work** **Exit Area Immediately Upon Emergency or Injury. Notify RTM, or Designee, Immediatly**	☐ FFNP ☐ FFAL ☐ SCBA ☐ PAPR ☐ Dust Mask ☐ Half Face ☐ Bubble Hood Cartridges: ☐ Particulate ☐ Vapor ☐ Combination ☐ Other

Special Instructions: *** As determined by: 1) RTM, or designee - task related / 2) RCT – unusual circumstance.**

SECTION V

RCT Requirements

1. Job Coverage: **Continuous** **X** * **Intermittent** **X** * **Start** **X** * **End of Job** **X** *
2. Air Sampling: **General Area** **X** * **Breathing Zone** **X** * Lapel ☐ AgZ ☐
   Tritium/C-14 ☐ Particulate ☐ Charcoal ☐ LoVol ☐ HiVol ☐
3. Exposure Rate Surveys: Start of Job ☐ Continuous Monitoring ☐ **Area Monitoring** **X** *
   Intermittent Monitoring ☐ End of Job ☐
4. Contamination Surveys: Start of Job ☐ Continuous Monitoring ☐
   Intermittent Monitoring **X** * **End of Job** **X** *
5. Is the ALARA Consideration Complete and Attached? Yes **No** Why? **Based on Section II / III Data**
6. Other: **No applying of make up, lip balm , or similar substances / acts while inside areas of concern. By signing to indicate RWP review, all such persons also acknowledge familiarity with prenatal exposure concerns as detailed in NRC Reg Guide 8.13, "Instruction Concerning Prenatal Radiation Exposure". Report existing cuts / open wounds to the RCT prior to reporting to work area.**
   - **As determined by: 1) RTM, or designee - task related / 2) RCT – unusual circumstance.**

RWP #: **2004-001 (HPS-Misc S & C -Routine, General)** Regular __X__ Extended ____

SECTION VI

Personnel Authorized to Perform Work & Acceptance of Responsibility

*My signature verifies that I have read and fully understand the RWP Requirements

Date	Name (Print)	Signature*	SSN (last 4 #'s)	Initial	Comments:

H	Approvals/Reviews	I	Termination
RTS Generating RWP: Date/Time:		Date: Time:	
SHSS Approval: Date/Time:		RTS/RTM (or designee)/RSO (if required):	
RTM (or designee) Approval: Date/Time:		Reason: Job Complete RWP Revision	
RSO Approval (if required): Date/Time:		RSO/RTM Review:	

(Modified for HPS use: 052504)

APPENDIX B

BASE-WIDE SAMPLING AND ANALYSIS PLAN

Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
San Diego, CA 92108-4310

CONTRACT NO. N62473-06-D-2201
CTO NO. 0006

APPENDIX B

FINAL

SAMPLING AND ANALYSIS PLAN
(Field Sampling Plan and Quality Assurance Project Plan)
October 5, 2007

BASE WIDE RADIOLOGICAL WORK PLAN
HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA

DCN: FWSD-RAC-05-0165.R1

TETRA TECH EC, INC.
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for 10/03/07

Gregory Joyce
Quality Control Program Manager
Date

10/4/2007

Narciso A. Ancog
NAVFAC SW Quality Assurance Officer
Date

ELEMENTS OF THE UFP-QAPP AND EPA QA/R-5 IN RELATION TO THIS SAP

UFP-QAPP Worksheet	EPA QA/R-5	This SAP	Variance from UFP-QAPP
#1 Title and Approval Page	A1. Title and Approval Sheet	Title and Approval Page	None
#2 QAPP Identifying Information	N/A	Sections 1.2 and 3.1, Table B.2-1, Work Plan Section 3.0	None
#3 Distribution List	A3. Distribution List	Table titled as Distribution List	None
#4 Project Personnel Sign-off Sheet	N/A	Table titled as Project Personnel Sign-off Sheet	None
#5 Project Organization Chart	A4. Project Task/Organization	Figure B.2-1	None
#6 Communication Pathways	N/A	Table B.2-2	None
#7 Personnel Responsibilities and Qualifications Table	A4. Project/Task Organization	Table B.2-1	None
#8 Special Personnel Training Requirements Table	A8. Special Training/Certification	Table B.2-3	None
#9 Project Scoping Sessions Participants Sheet	N/A	N/A	Sign-in sheets and meeting minutes of scoping sessions are maintained in the DON project file.
#10 Problem Definition	A5. Problem Definition/Background A6. Project/Task Description	Step 1 of Sections 3.1 and 3.2, Section 3.3	None
#11 Project Quality Objectives/Systematic Planning Process Statements	A7. Quality Objectives and Criteria	Sections 6.0 and 7.0	None
#12 Measurement Performance Criteria Table	B5. Quality Control	Not included	Field QC samples are not applicable to this project as described in Section 7.4.

ELEMENTS OF THE UFP-QAPP AND EPA QA/R-5 IN RELATION TO THIS SAP

UFP-QAPP Worksheet	EPA QA/R-5	This SAP	Variance from UFP-QAPP
#13 Secondary Data Criteria and Limitations Table	N/A	N/A	None
#14 Summary of Project Tasks	A6. Project/Task Description	Section 5.0, Table B.5-1, Sections 8.1 and 8.2, and Table B.8-1	None
#15 Reference Limits and Evaluation Table	N/A	Tables B.7-1 and B.7-2	None
#16 Project Schedule/Timeline Table	N/A	Not included	Will be addressed in each site-specific Design Plan
#17 Sampling Design and Rationale	B1. Sample Process Design	Section 5.1	None
#18 Sampling Locations and Methods/SOP Requirement Table	N/A	Table B.5-1	None
#19 Analytical SOP Requirement Table	N/A	Table B.6-1	None
#20 Field Quality Control Sample Summary Table	B5. Quality Control	Not included	Field QC samples are not applicable to this project as described in Section 7.4.
#21 Project Sampling SOP Reference Table	B2. Sampling Methods	Section 6.3	None
#22 Field Equipment Calibration, Maintenance, Testing, and Inspection Table	B6. Instrument/Equipment Testing, Inspection, and Maintenance B7. Instrument/Equipment Calibration and Frequency	Sections 4.8 and 4.9 of the Work Plan	None
#23 Analytical SOP Reference Table	B4. Analytical Methods	Not included	Information will be provided with the laboratory data packages.
#24 Analytical Instrument Calibration Table	N/A	Table 4-2 of the Work Plan	None

ELEMENTS OF THE UFP-QAPP AND EPA QA/R-5 IN RELATION TO THIS SAP

UFP-QAPP Worksheet	EPA QA/R-5	This SAP	Variance from UFP-QAPP
#25 Analytical Instrument and Equipment, Maintenance, Testing, and Inspection Table	N/A	Not included	Information on analytical instruments will be in accordance with laboratories QA plan as described in Section 7.1.4.9.
#26 Sampling Handling System	B3. Sample Handling and Custody	Section 6.5	None
#27 Sample Custody Requirements	B3. Sample Handling and Custody	Sections 4.1.4 and 7.1.2	None
#28 Quality Control Samples Table	B5. Quality Control	Table B.7-3	None
#29 Project Documents and Records Table	A9. Project Documents and Records	Table B.4-1	None
#30 Analytical Services Table	N/A	Not included	Analytical data package turnaround time is identified in Section 8.1.2.
#31 Planned Project Assessment Table	C1. Assessment and Response Actions	Table B.9-1	None
#32 Assessment Findings and Response Actions	C1. Assessment and Response Actions	Table B.9-2	None
#33 QA Management Reports Table	C2. Reports to Management	Table B.9-3	None
#34 Sampling and Analysis Verification (Step 1) Process Table	D1. Data Review, Verification, and Validation D2. Verification and Validation Methods	Table B.8-1	None
#35 Sampling and Analysis Validation (Steps 2a and 2b) Process Table	D1. Data Review, Verification, and Validation	Table B.8-2	None
#36 Sampling and Analysis Validation (Steps 2a and 2b) Summary Table	D1. Data Review, Verification, and Validation	Section 8.2	None
#37 Data Usability Assessment	D3. Reconciliation with User Requirements	Section 8.2	None

ELEMENTS OF THE UFP-QAPP AND EPA QA/R-5 IN RELATION TO THIS SAP

Abbreviations and Acronyms:

DON – Department of the Navy
EPA – U.S. Environmental Protection Agency
N/A – not applicable
QA – quality assurance
QAPP – Quality Assurance Project Plan
QC – quality control
SAP – Sampling and Analysis Plan
SOP – Standard Operating Procedure
TtEC – Tetra Tech EC, Inc.
UFP-QAPP – Uniform Federal Policy for Quality Assurance Project Plans

I certify that this SAP is in compliance with the latest version of the UFP-QAPP and the EPA QA/R-5

Gregory Joyce	Lisa A. Birkowski for	10/03/07
PRINT NAME (TtEC Quality Control Program Manager)	SIGNATURE	DATE

DISTRIBUTION LIST
(UFP-QAPP Worksheet #3)

This document will be distributed to the project participants listed below once all approval signatures have been received.

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Abbreviations and Acronyms:

Cal/EPA – California Environmental Protection Agency
CSO – Caretaker Site Office
DON – Department of the Navy
DTSC – Department of Toxic Substances Control
EPA – U.S. Environmental Protection Agency
HPS – Hunters Point Shipyard
NAVFAC SW – Naval Facilities Engineering Command, Southwest
QAO – Quality Assurance Officer
QC – quality control
RASO – Radiological Affairs Support Office
ROICC – Resident Officer in Charge of Construction
RPM – Remedial Project Manager
SAP – Sampling and Analysis Plan
UFP-QAPP – Uniform Federal Policy for Quality Assurance Project Plan
USFWS – United States Fish and Wildlife Service

PROJECT PERSONNEL SIGN-OFF SHEET
(UFP-QAPP Worksheet #4)

I have read and understood the SAP and shall perform the tasks as described.

Project Personnel	Organization	Title	Signature	Date SAP Read
Mr. William Dougherty	Tetra Tech EC, Inc.	Project Manager		
Mr. Gregory Joyce	Tetra Tech EC, Inc.	Quality Control Program Manager		
Ms. Lisa A. Bienkowski	Tetra Tech EC, Inc.	Program Chemist		
Ms. Sabina Sudoko	Tetra Tech EC, Inc.	Project Chemist		
Mr. Cliff Stephan	Tetra Tech EC, Inc.	Radiation Safety Officer		
Mr. Daryl Delong	Radiological Survey & Remedial Services, LLC	Project Radiation Safety Officer		
Mr. John Polyak	New World Technology, Inc.	Radiation Task Manager		
Mr. Bert Bowers	New World Technology, Inc.	Radiation Safety Office Representative		
Mr. Paul Wall	New World Technology, Inc.	Laboratory Project Manager		

Abbreviations and Acronyms:

SAP – Sampling and Analysis Plan
UFP-QAPP – Uniform Federal Policy for Quality Assurance Project Plans

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ATTACHMENTS

ABBREVIATIONS AND ACRONYMS

β	beta
°C	degree Celsius
%R	percent recovery
^{90}Sr	strontium-90
AM	Action Memorandum
Cal/EPA	California Environmental Protection Agency
CCV	continuing calibration verification
CFR	Code of Federal Regulations
COC	chain of custody
CTO	Contract Task Order
DHS	Department of Health Services
DoD	Department of Defense
DON	Department of the Navy
DQO	data quality objective
DTSC	Department of Toxic Substances Control
EDD	electronic data deliverable
EM	Engineering Manual
EPA	U.S. Environmental Protection Agency
EWI	Environmental Work Instruction
FCR	Field Change Request
FSS	Final Status Survey
GC/MS	gas chromatograph/mass spectrometer
HPS	Hunters Point Shipyard
HRA	Historical Radiological Assessment
ICAL	initial calibration
IRCDQM	Installation Restoration Chemical Data Quality Manual
LCS/LCSD	laboratory control sample/ laboratory control sample duplicate
LLRW	low-level radiological waste
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDA	minimum detectable activity

ABBREVIATIONS AND ACRONYMS
(Continued)

MDL	method detection limit
mL	milliliter
MS/MSD	matrix spike/matrix spike duplicate
NAVFAC SW	Naval Facilities Engineering Command, Southwest
NAVSEA	Naval Sea Systems Command
NEDD	Navy electronic data deliverable
NFECSW	Naval Facilities Engineering Command - Southwest
NWT	New World Technologies, Inc.
OSHA	Occupational Safety and Health Administration
PARCC	precision, accuracy, representativeness, completeness, and comparability
PjM	Project Manager
PPE	personal protective equipment
PQCM	Project Quality Control Manager
PRSO	Project Radiation Safety Officer
QA	quality assurance
QAO	Quality Assurance Officer
QC	quality control
QCM	Quality Control Program Manager
QL	quantitation limit
QSM	Quality Systems Manual
RAC	Remedial Action Contract
RASO	Radiological Affairs Support Office
ROC	radionuclide of concern
RPD	relative percent difference
RPM	Remedial Project Manager
RRO	radiological remedial objective
RSO	Radiation Safety Officer
RSOR	Radiation Safety Office Representative
RTM	Radiation Task Manager

ABBREVIATIONS AND ACRONYMS
(Continued)

SAP	Sampling and Analysis Plan
SDG	sample delivery group
SOP	Standard Operating Procedure
SOW	scope of work
TSP	Task-specific Plan
TtEC	Tetra Tech EC, Inc.
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plans

1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) has been prepared by Tetra Tech EC, Inc. (TtEC), under the Naval Facilities Engineering Command, Southwest (NAVFAC SW) Remedial Action Contract (RAC) IV No. N62473-06-D-2201, Contract Task Order (CTO) No. 0006. This SAP supersedes the *Base-Wide Radiological Work Plan* (Tetra Tech FW, Inc., 2005), *Sampling and Analysis Plan for the Base-Wide Radiological Work Plan* (DCN: FWSD-RAC-05-0165) prepared under RAC III No. N68711-98-D-5713, CTO No. 0072.

This SAP was prepared as a replacement to the prior version, due to changes in analysis methods available to the on-site radiological laboratory, to update quality assurance (QA) and quality control (QC) requirements, and to make editorial changes to the project management and reporting structure, all which have changed in the previous 2 years since the last SAP was published. This SAP will also be updated to be in compliance with the latest format from *Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP)* (U.S. Environmental Protection Agency [EPA], 2005) and *EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5, QAMS* (EPA, 2006) to ensure that all data collected are precise, accurate, representative, complete, and comparable to meet their intended use.

The purpose of this SAP is to establish procedures for sampling, including sample analysis, and associated QA activities integral to performing radiological surveys at Hunters Point Shipyard (HPS), San Francisco, California. Individual Task-specific Plans (TSPs), which include task-specific sampling and analysis elements and data quality objectives (DQOs), will be prepared for each site or building that will be surveyed.

Included in this SAP (either directly or by specific reference to the Base-wide Plan) are sampling procedures, laboratory analysis, and QA/ QC requirements that will be used during this project. General DQOs for conducting radiological surveys are provided in this document (Section 3.3), and task-specific DQOs will be included in the TSPs. DQOs are developed using the guidance provided in the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) (Department of Defense [DoD] et al., 2000).

This SAP will be used as a reference document by all field and laboratory personnel (as listed in the distribution list) engaged in the sampling and analysis activities for the removal projects. These procedures will be used throughout the project by all field and laboratory personnel. Each TSP will provide location-specific supplemental information and identify exceptions and/or additions to this SAP, if any.

1.1 OBJECTIVES

The objectives of this SAP are to: 1) provide guidance for the field sampling activities; 2) describe and establish consistent field sampling procedures; 3) establish data gathering, handling, and documentation methods; and, 4) define QA/QC measures to ensure consistency and confidence in the data obtained.

The Department of the Navy (DON) reviewed the Hunters Point Shipyard operational history, the *Final Historical Radiological Assessment, Volume II* (Naval Sea Systems Command [NAVSEA], 2004) and site-specific investigative data and has determined that several buildings and areas may contain radioactive material requiring a response action. This decision is documented in the *Final Basewide Radiological Removal Action, Action Memorandum-Revision 2006, Hunters Point Shipyard, San Francisco, California* (DON, 2006), which was prepared to direct removal actions within various areas throughout the base that contain radioactive contamination (hereinafter referred to as the Action Memorandum [AM]) (DON, 2006). These surveys, which may lead to removal actions, will serve to characterize the dose or risk to the average member of the critical group, and if contamination is found, to substantially eliminate the potential threat posed by future migration and/or off-site release of radioactive material present at the base into the surrounding environment. Currently, such a release could occur as a result of wastewater or stormwater transport, erosion, weathering, seismic events, or biological activity.

The primary objectives of this SAP are to establish sampling procedures associated with surveys to evaluate areas that may contain residual radioactive contamination as a result of past activities at HPS. The *Final Historical Radiological Assessment, Volume II* (HRA) (NAVSEA, 2004) lists specific radionuclides of concern (ROC) for the building and site. However, it was not intended to limit the radioactive contaminants to those isotopes, and additional isotopes will be evaluated during the performance of this work as appropriate. The ROC applicable to the building or site under investigation will be listed in TSPs prepared under the Base-wide Work Plan and this SAP.

If additional radionuclides are encountered, the cleanup goals established in the AM (DON, 2006) will be adopted. The most current version or revision to the AM will be referenced in each TSP to establish the applicable radiological remedial objective(s) (RRO), and may differ from the values listed in Table B.1-1, since these values are only current as of the date of publication of this SAP. Radioactive materials encountered during removal actions that exceed any RRO will be removed for disposal as radioactive waste.

1.2 ACTION LEVELS

Prior radiological investigations have confirmed the presence of radiological contamination in buildings and sites within HPS. The presence of other radionuclides will be assessed during the screening process activities. Table B.1-1 provides the RROs for these and other radionuclides,

which are published in the AM and were established by the DON in consonance with the EPA, Region IX. Radiologically impacted sites at HPS and their ROC are included on Table B.1-2.

1.3 REGULATORY OVERSIGHT

The DON (represented by the Base Realignment and Closure Program Management Office West, Radiological Affairs Support Office [RASO], and NAVFAC SW) is the lead agency responsible for this project. The EPA is the lead regulatory agency, with state regulatory oversight provided by the California Environmental Protection Agency (Cal/EPA), Department of Toxic Substances (DTSC), and Regional Water Quality Control Board.

TABLE B.1-1

RADIOLOGICAL REMEDIAL OBJECTIVES

Radionuclide	Surfaces (dpm/100 cm^2)		Soil[c] (pCi/g)		Water[f] (pCi/L)
	Equipment Waste[a]	Structures[b]	Outdoor Worker[d]	Residential[d]	
Americium-241	100	100	5.67	1.36	15
Cesium-137	5,000	5,000	0.113	0.113	119
Cobalt-60	5,000	5,000	0.0602	0.0361	100
Plutonium-239	100	100	14.0	2.59	15
Radium-226	100	100	1.0[e]	1.0[e]	5.0[g]
Strontium-90	1,000	1,000	10.8	0.331	8
Thorium-232	1,000	36.5	2.7	1.69	15
Tritium (^3H)	5,000	5,000	4.23	2.28	20,000
Uranium-235+D	5,000	488	0.398	0.195	30

Notes:

[a] These limits are based on AEC *Regulatory Guide 1.86*. Limits for removable surface activity are 20 percent of these values.

[b] These limits are based on 25 mrem/y, using RESRAD-Build Version 3.3 or *Regulatory Guide 1.86*, whichever is lower.

[c] EPA PRGs for two future-use scenarios.

[d] The on-site and off-site laboratory will ensure that the MDA meets the listed release criteria by increasing sample size or counting time as necessary. The MDA is defined as the lowest net response level, in counts, that can be seen with a fixed level of certainty, customarily 95 percent. The MDA is calculated per sample by considering background counts, amount of sample used, and counting time.

[e] Limit is 1 pCi/g above background per agreement with EPA.

[f] Release criteria for water have been derived from *Radionuclides Notice of Data Availability Technical Document*, (EPA, 2000) by comparing the limits from two criteria and using the most conservative limit.

[g] Limit is for total radium concentration.

Abbreviations and Acronyms:

AEC – Atomic Energy Commission
cm^2 – square centimeter
dpm – disintegration per minute
EPA – U.S. Environmental Protection Agency
MDA – minimum detectable activity
mrem/y – millirem per year
pCi/g – picocurie per gram
pCi/L – picocurie per liter
PRG – Preliminary Remediation Goal
SAP – Sampling and Analysis Plan

TABLE B.1-2

BUILDING/AREA ASSESSMENT AND CLASSIFICATION AND ASSOCIATED ISOTOPES OF CONCERN

Building No. or Area	Contamination Potential					Contaminated Media							Potential Migration Pathways							Recommended Actions	Isotopes of Concern
	Known-restricted Access	Known-continued Access	Likely	Unlikely	Unknown	Surface Soil	Subsurface Soils	Surface Water	Groundwater	Air	Structures	Drainage System	Surface Soil	Subsurface Soil	Surface Water	Groundwater	Air	Structures	Drainage System		
Parcel B																					
103				✓		N	N	N	N	N	L	L	N	N	N	N	N	L	N	Review Final Status Survey Report	^{137}Cs, ^{239}Pu, and ^{90}Sr
113				✓		N	N	N	N	N	L	N	N	N	N	N	N	L	N	Review Final Status Survey Report	^{137}Cs, ^{239}Pu, and ^{90}Sr
113A				✓		N	N	N	N	N	L	N	N	N	N	N	N	L	N	Review Final Status Survey Report	^{137}Cs and ^{226}Ra
114				✓		L	N	N	N	N	N	N	L	N	N	N	N	N	N	Scoping Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr
130				✓		N	N	N	N	N	L	N	N	N	N	N	N	L	N	Review Final Status Survey Report	^{137}Cs and ^{226}Ra
140 and Discharge Channel				✓		N	N	N	N	N	L	L	N	N	N	N	N	L	L	Scoping Survey	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
142				✓		L	N	N	N	N	L	N	L	N	N	N	N	L	N	Scoping Survey	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
146			✓			N	N	N	N	N	L	N	N	N	N	N	N	L	N	Characterization Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr

TABLE B.1-2

BUILDING/AREA ASSESSMENT AND CLASSIFICATION AND ASSOCIATED ISOTOPES OF CONCERN

Building No. or Area	Contamination Potential					Contaminated Media							Potential Migration Pathways							Recommended Actions	Isotopes of Concern
	Known-restricted Access	Known-continued Access	Likely	Unlikely	Unknown	Surface Soil	Subsurface Soils	Surface Water	Groundwater	Air	Structures	Drainage System	Surface Soil	Subsurface Soil	Surface Water	Groundwater	Air	Structures	Drainage System		
157				✓		N	N	N	N	N	L	N	N	N	N	N	N	L	N	Scoping Survey	^{60}Co, ^{137}Cs, and ^{226}Ra
IR-07				✓		L	L	N	N	N	N	N	L	L	N	N	N	N	N	Scoping Survey	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
IR-18				✓		L	L	N	N	N	N	N	L	L	N	N	N	N	N	Scoping Survey	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
Drydock 5				✓		N	N	N	N	N	L	L	N	N	N	N	N	L	L	Scoping Survey	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
Drydock 6				✓		N	N	N	N	N	L	L	N	N	N	N	N	L	L	Review Final Status Survey Report	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
Drydock 7				✓		N	N	N	N	N	L	L	N	N	N	N	N	L	L	Scoping Survey	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr

TABLE B.1-2

BUILDING/AREA ASSESSMENT AND CLASSIFICATION AND ASSOCIATED ISOTOPES OF CONCERN

Building No. or Area	Contamination Potential					Contaminated Media							Potential Migration Pathways							Recommended Actions	Isotopes of Concern
	Known-restricted Access	Known-continued Access	Likely	Unlikely	Unknown	Surface Soil	Subsurface Soils	Surface Water	Groundwater	Air	Structures	Drainage System	Surface Soil	Subsurface Soil	Surface Water	Groundwater	Air	Structures	Drainage System		
Parcel C																					
203				✓		L	N	N	N	N	L	N	L	N	N	N	N	L	N	Scoping Survey	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
205 and Discharge Channel				✓		N	N	N	N	N	L	L	N	N	N	N	N	L	L	Scoping Survey	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
211		✓				N	N	N	N	N	M	L	N	N	N	N	N	L	L	Remediation and Final Status Survey	^{137}Cs, ^{226}Ra, and ^{232}Th
214				✓		N	N	N	N	N	L	N	N	N	N	N	N	L	N	Review Final Status Survey Report	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
224			✓			N	N	N	N	N	L	N	N	N	N	N	N	L	N	Review Final Status Survey Report	^{137}Cs, ^{239}Pu, and ^{90}Sr
241				✓		N	N	N	N	N	L	N	N	N	N	N	N	L	N	Review Final Status Survey Report	NORM
253		✓				N	N	N	N	N	H	H	N	N	N	N	N	M	M	Remediation and Final Status Survey	^{137}Cs, ^{239}Pu, ^{226}Ra, ^{90}Sr, and ^{232}Th

TABLE B.1-2

BUILDING/AREA ASSESSMENT AND CLASSIFICATION AND ASSOCIATED ISOTOPES OF CONCERN

Building No. or Area	Contamination Potential					Contaminated Media							Potential Migration Pathways							Recommended Actions	Isotopes of Concern
	Known-restricted Access	Known-continued Access	Likely	Unlikely	Unknown	Surface Soil	Subsurface Soils	Surface Water	Groundwater	Air	Structures	Drainage System	Surface Soil	Subsurface Soil	Surface Water	Groundwater	Air	Structures	Drainage System		
271				✓		N	N	N	N	N	L	N	N	N	N	N	N	L	N	Review Final Status Survey Report	^{226}Ra
272				✓		N	N	N	N	N	L	N	N	N	N	N	N	L	N	Review Final Status Survey Report	^{60}Co, ^{137}Cs, and ^{226}Ra
Drydock 2			✓			N	N	N	N	N	M	L	N	N	N	N	N	L	L	Review Final Status Survey Report	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
Drydock 3			✓			N	N	N	N	N	M	L	N	N	N	N	N	L	L	Review Final Status Survey Report	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
Drydock 4			✓			N	N	N	N	N	M	L	N	N	N	N	N	L	L	Review Final Status Survey Report	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
Parcel D																					
274				✓		N	N	N	N	N	L	N	N	N	N	N	N	L	N	Review Final Status Survey Report	^{137}Cs, ^{226}Ra, and ^{90}Sr
313 Site			✓			L	L	N	N	N	N	N	L	L	N	N	N	N	N	Review Final Status Survey Report	^{137}Cs, ^{239}Pu, ^{226}Ra, ^{90}Sr, and ^{232}Th

TABLE B.1-2

BUILDING/AREA ASSESSMENT AND CLASSIFICATION AND ASSOCIATED ISOTOPES OF CONCERN

Building No. or Area	Contamination Potential					Contaminated Media							Potential Migration Pathways							Recommended Actions	Isotopes of Concern
	Known-restricted Access	Known-continued Access	Likely	Unlikely	Unknown	Surface Soil	Subsurface Soils	Surface Water	Groundwater	Air	Structures	Drainage System	Surface Soil	Subsurface Soil	Surface Water	Groundwater	Air	Structures	Drainage System		
313A Site			✓			M	L	N	N	N	N	M	L	L	N	N	N	N	L	Review Final Status Survey Report	^{137}Cs, ^{239}Pu, ^{226}Ra, ^{90}Sr, and ^{232}Th
317 Site			✓			L	L	N	N	N	N	N	L	L	N	N	N	N	N	Review Final Status Survey Report	^{137}Cs, ^{226}Ra, and ^{90}Sr
322 Site			✓			L	N	N	N	N	N	N	L	N	N	N	N	N	N	Review Final Status Survey Report	^{137}Cs, ^{239}Pu, ^{226}Ra, ^{90}Sr, and ^{232}Th
351			✓			N	N	N	N	N	M	L	N	N	N	N	N	L	L	Review Final Status Survey Report	^{137}Cs, ^{226}Ra, ^{90}Sr, and ^{232}Th
351A		✓				M	N	N	N	N	M	M	M	N	N	N	N	L	L	Characterization Survey	^{137}Cs, ^{239}Pu, ^{226}Ra, ^{90}Sr, and ^{232}Th
364		✓				H	M	N	N	N	H	H	M	L	N	N	N	M	M	Remediation and Final Status Survey	^{60}Co, ^{137}Cs, ^{239}Pu, ^{226}Ra, ^{90}Sr, and ^{235}U
365				✓		N	N	N	N	N	L	L	N	N	N	N	N	L	L	Review Final Status Survey Report	^{137}Cs, ^{239}Pu, ^{226}Ra, ^{90}Sr, and ^{235}U
366/351B		✓				N	N	N	N	N	M	M	N	N	N	N	N	L	L	Remediation and Final Status Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr

TABLE B.1-2

BUILDING/AREA ASSESSMENT AND CLASSIFICATION AND ASSOCIATED ISOTOPES OF CONCERN

Building No. or Area	Contamination Potential					Contaminated Media							Potential Migration Pathways							Recommended Actions	Isotopes of Concern
	Known-restricted Access	Known-continued Access	Likely	Unlikely	Unknown	Surface Soil	Subsurface Soils	Surface Water	Groundwater	Air	Structures	Drainage System	Surface Soil	Subsurface Soil	Surface Water	Groundwater	Air	Structures	Drainage System		
383				✓		N	N	N	N	N	L	N	N	N	N	N	N	L	N	Review Final Status Survey Report	^{3}H, ^{226}Ra, and ^{90}Sr
408			✓			N	N	N	N	N	M	N	N	N	N	N	N	L	N	Scoping Survey	^{226}Ra
411				✓		N	N	N	N	N	L	N	N	N	N	N	N	L	N	Review Final Status Survey Report	^{60}Co, ^{137}Cs, and ^{226}Ra
Gun Mole(Regunning)Pier			✓			L	L	N	N	N	L	N	L	L	N	N	N	L	N	Review Characterization Report	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
500				✓		N	N	N	N	N	L	N	N	N	N	N	N	L	N	Scoping Survey	^{137}Cs and ^{226}Ra
503 Site			✓			N	L	N	N	N	N	L	N	L	N	N	N	N	L	Scoping Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr
Mahan Street-NRDL			✓			M	M	N	N	N	N	N	L	L	N	N	N	N	N	Review Final Status Survey Report	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
813				✓		N	N	N	N	N	L	N	N	N	N	N	N	L	N	Scoping Survey	^{90}Sr
819			✓			N	N	N	N	N	L	M	N	N	N	N	N	L	M	Scoping Survey	^{137}Cs and ^{226}Ra

TABLE B.1-2

BUILDING/AREA ASSESSMENT AND CLASSIFICATION AND ASSOCIATED ISOTOPES OF CONCERN

Building No. or Area	Contamination Potential					Contaminated Media							Potential Migration Pathways							Recommended Actions	Isotopes of Concern
	Known-restricted Access	Known-continued Access	Likely	Unlikely	Unknown	Surface Soil	Subsurface Soils	Surface Water	Groundwater	Air	Structures	Drainage System	Surface Soil	Subsurface Soil	Surface Water	Groundwater	Air	Structures	Drainage System		
Parcel E																					
406			✓			**N**	**N**	**N**	**N**	**N**	**M**	**N**	**N**	**N**	**N**	**N**	**N**	**L**	**N**	Review Final Status Survey Report	^{137}Cs and ^{226}Ra
414				✓		**N**	**N**	**N**	**N**	**N**	**L**	**N**	**N**	**N**	**N**	**N**	**N**	**L**	**N**	Review Final Status Survey Report	^{226}Ra
500 Building Series			✓			**M**	**H**	**N**	**N**	**N**	**N**	**H**	**L**	**M**	**N**	**N**	**N**	**N**	**H**	Scoping Survey	^{241}Am, ^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
506 Site			✓			**M**	**M**	**N**	**N**	**N**	**N**	**M**	**L**	**L**	**N**	**N**	**N**	**N**	**M**	Scoping Survey	^{241}Am, ^{137}Cs, ^{3}H, ^{239}Pu, ^{226}Ra, and ^{90}Sr
507 Site			✓			**L**	**L**	**N**	**N**	**N**	**N**	**M**	**L**	**L**	**N**	**N**	**N**	**N**	**L**	Characterization Survey	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
508 Site			✓			**L**	**L**	**N**	**N**	**N**	**N**	**M**	**L**	**L**	**N**	**N**	**N**	**N**	**L**	Characterization Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr
509 Site			✓			**L**	**L**	**N**	**N**	**N**	**N**	**M**	**L**	**L**	**N**	**N**	**N**	**N**	**L**	Characterization Survey	^{137}Cs and ^{90}Sr
510 Site			✓			**L**	**L**	**N**	**N**	**N**	**N**	**M**	**L**	**L**	**N**	**N**	**N**	**N**	**L**	Characterization Survey	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr

TABLE B.1-2

BUILDING/AREA ASSESSMENT AND CLASSIFICATION AND ASSOCIATED ISOTOPES OF CONCERN

Building No. or Area	Contamination Potential					Contaminated Media							Potential Migration Pathways							Recommended Actions	Isotopes of Concern
	Known-restricted Access	Known-continued Access	Likely	Unlikely	Unknown	Surface Soil	Subsurface Soils	Surface Water	Groundwater	Air	Structures	Drainage System	Surface Soil	Subsurface Soil	Surface Water	Groundwater	Air	Structures	Drainage System		
510A Site			✓			L	L	N	N	N	N	M	L	L	N	N	N	N	L	Scoping Survey	^{137}Cs and ^{90}Sr
517 Site			✓			L	L	N	N	N	N	M	L	L	N	N	N	N	L	Characterization Survey	^{60}Co, ^{137}Cs, and ^{90}Sr
520 Site		✓				M	M	N	N	N	N	M	M	M	N	N	N	N	L	Characterization Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr
521				✓		L	N	N	N	N	L	N	N	N	N	N	N	N	N	Scoping Survey	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
529 Site		✓				M	M	N	N	N	M	H	L	L	N	N	N	L	M	Scoping Survey	^{137}Cs, ^{3}H, ^{226}Ra, and ^{90}Sr
701 Site				✓		L	N	N	N	N	N	N	L	N	N	N	N	N	N	Review Final Status Survey Report	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
704 Area			✓			L	L	N	N	N	N	N	L	L	N	N	N	N	N	Scoping Survey	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
704/Pens				✓		L	L	N	N	N	N	N	L	L	N	N	N	N	N	Scoping Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr
707/Kennels		✓				L	L	N	N	N	L	M	L	L	N	N	N	L	M	Characterization Survey	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr

TABLE B.1-2

BUILDING/AREA ASSESSMENT AND CLASSIFICATION AND ASSOCIATED ISOTOPES OF CONCERN

Building No. or Area	Contamination Potential					Contaminated Media							Potential Migration Pathways							Recommended Actions	Isotopes of Concern
	Known-restricted Access	Known-continued Access	Likely	Unlikely	Unknown	Surface Soil	Subsurface Soils	Surface Water	Groundwater	Air	Structures	Drainage System	Surface Soil	Subsurface Soil	Surface Water	Groundwater	Air	Structures	Drainage System		
707 B Site				✓		L	L	N	N	N	N	N	N	L	N	N	N	N	L	Characterization Survey (as part of 707 Triangle Area Survey)	^{137}Cs, ^{226}Ra, and ^{90}Sr
707 C Site				✓		L	L	N	N	N	N	N	L	L	N	N	N	N	N	Characterization Survey as (part of 707 Triangle Area Survey)	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
707 Triangle Area		✓				L	H	N	N	N	N	H	L	M	N	N	N	N	M	Characterization Survey	^{137}Cs, ^{239}Pu, ^{226}Ra, ^{90}Sr, and ^{235}U
708				✓		L	N	N	N	N	L	N	L	N	N	N	N	N	N	Review Final Status Survey Report	^{137}Cs and ^{90}Sr
719 Site				✓		L	L	N	N	N	N	N	L	N	N	N	N	N	N	Scoping Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr
807 Site				✓		L	L	N	N	N	N	N	L	L	N	N	N	L	N	Scoping Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr
810		✓				M	N	N	N	N	M	N	L	N	N	N	N	L	N	Remediation and Scoping Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr
Shack 79 Site			✓			M	L	N	N	N	N	N	L	L	N	N	N	N	N	Final Status Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr

TABLE B.1-2

BUILDING/AREA ASSESSMENT AND CLASSIFICATION AND ASSOCIATED ISOTOPES OF CONCERN

Building No. or Area	Contamination Potential					Contaminated Media							Potential Migration Pathways							Recommended Actions	Isotopes of Concern
	Known-restricted Access	Known-continued Access	Likely	Unlikely	Unknown	Surface Soil	Subsurface Soils	Surface Water	Groundwater	Air	Structures	Drainage System	Surface Soil	Subsurface Soil	Surface Water	Groundwater	Air	Structures	Drainage System		
Shack 80 Site		✓				H	M	N	N	N	N	N	M	L	N	N	N	N	N	Remediation and Final Status Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr
Experimental Shielding Range			✓			M	L	N	N	N	N	N	L	L	N	N	N	N	N	Review Final Status Survey Report	^{60}Co, ^{137}Cs, and ^{226}Ra
IR-01/21, Industrial Landfill		✓				H	H	N	N	N	N	N	M	M	N	N	N	N	N	Review Characterization Survey Report, Remediation, and Final Status Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr
IR-02, Bay Fill		✓				H	H	N	L	N	N	N	M	M	N	L	N	N	N	Characterization Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr
IR-03			✓			M	M	N	N	N	N	N	L	L	N	N	N	N	N	Scoping Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr
IR-04		✓				H	M	N	N	N	N	N	M	L	N	N	N	N	N	Characterization Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr
Former Salvage Yard			✓			M	M	N	N	N	N	N	L	L	N	N	N	N	N	Scoping Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr
Shoreline		✓				H	M	L	N	N	N	N	M	M	L	N	N	N	N	Characterization Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr

TABLE B.1-2

BUILDING/AREA ASSESSMENT AND CLASSIFICATION AND ASSOCIATED ISOTOPES OF CONCERN

Building No. or Area	Contamination Potential					Contaminated Media							Potential Migration Pathways							Recommended Actions	Isotopes of Concern
	Known-restricted Access	Known-continued Access	Likely	Unlikely	Unknown	Surface Soil	Subsurface Soils	Surface Water	Groundwater	Air	Structures	Drainage System	Surface Soil	Subsurface Soil	Surface Water	Groundwater	Air	Structures	Drainage System		
Base-wide																					
Storm Drain lines		✓				N	L	N	N	N	L	H	N	L	N	N	N	L	M	Scoping/Characterization Surveys of systems associated with NRDL sites or sites associated with radium use	^{137}Cs, ^{226}Ra, and ^{90}Sr
Sanitary Sewers		✓				N	L	N	N	N	L	H	N	L	N	N	N	L	M	Scoping/Characterization Survey of systems associated with NRDL sites or sites associated with radium use	^{137}Cs, ^{226}Ra, and ^{90}Sr
Septic Systems			✓			N	M	N	N	N	N	H	N	L	N	N	N	N	M	Scoping/Characterization Surveys of systems associated with NRDL buildings	^{137}Cs, ^{226}Ra, and ^{90}Sr

TABLE B.1-2

BUILDING/AREA ASSESSMENT AND CLASSIFICATION AND ASSOCIATED ISOTOPES OF CONCERN

Building No. or Area	Contamination Potential					Contaminated Media							Potential Migration Pathways							Recommended Actions	Isotopes of Concern
	Known-restricted Access	Known-continued Access	Likely	Unlikely	Unknown	Surface Soil	Subsurface Soils	Surface Water	Groundwater	Air	Structures	Drainage System	Surface Soil	Subsurface Soil	Surface Water	Groundwater	Air	Structures	Drainage System		
Parcel F																					
Underwater Areas			✓			N	L	N	N	N	N	N	L	N	N	N	N	N	N	Scoping Surveys in areas of Operation CROSSROADS decontamination activities and site outfall discharge	^{137}Cs, ^{239}Pu, ^{226}Ra, ^{90}Sr, and ^{235}U
All Ships' Berths				✓		L	L	N	N	N	L	N	N	L	N	N	N	L	N	Review Final Status Survey Report for completed berths; Scoping Survey on remainder	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
Off-site Facility																					
ICW 418				✓		N	N	N	N	N	L	N	N	N	N	N	N	L	N	Scoping Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr

TABLE B.1-2

BUILDING/AREA ASSESSMENT AND CLASSIFICATION AND ASSOCIATED ISOTOPES OF CONCERN

Abbreviations and Acronyms:

H High = Evidence of contamination in the media or migration pathway has been identified.
L Low = The potential for contamination in the type of media or migration pathway is remote.
M Moderate = The potential for contamination in the media or migration pathway exists, although the extent has not been fully assessed.
N None = Evidence of contamination in the specific media or migration pathway has not been found, or known contamination has been removed, and surveys indicate that the media or migration pathway meets today's release criteria.

^{241}Am – americium-241
^{60}CO – cobalt-60
^{137}Cs – cesium-137
^{3}H – hydrogen-3
NRDL – Navy Radiological Defense Laboratory
^{239}Pu – plutonium-239
^{226}RA – radium-226
^{90}Sr – strontium-90
^{232}Th – thorium-232
^{235}U – uranium-235

2.0 PROJECT ORGANIZATION

This section describes project organization, the communication pathway that will be used, and general and specialized training requirements.

2.1 PROJECT ORGANIZATION

Key personnel from the DON and TtEC responsible for the oversight and/or implementation of the proposed field activities include the NAVFAC SW Quality Assurance Officer (QAO), NAVFAC SW Remedial Project Manager (RPM), Project Manager, Radiological Site Manager, Radiation Safety Officer (RSO), Radiation Safety Office Representative (RSOR), Project Radiation Safety Officer (PRSO), on-site Laboratory Project Manger, Radiation Task Manager (RTM) Quality Control Program Manager (QCM), Program Chemist, Project Chemist, and Data Manager. The project organization chart shown in Figure B.2-1 provides lines of responsibility and communication. In addition, responsibilities of each of the key personnel are listed in Table B.2-1.

Table B.2-2 describes the communication pathways and modes of communication that will be used during the project. These pathways include obtaining approval between project personnel, subcontractors, and the DON.

2.2 TRAINING REQUIREMENTS

Project on-site personnel are required to meet the Occupational Safety and Health Administration (OSHA) training requirements defined in Title 29 Code of Federal Regulations (CFR), Part 1910.120(e). These requirements include 40 hours of formal instruction, a minimum of 3 days of actual on-site field experience under the supervision of a trained and experienced field supervisor, and 8 hours of annual refresher training.

Before work begins, project personnel will receive the following site-specific training:

- Names of personnel and alternates responsible for health and safety at the project site
- Health and safety hazards present on site
- Selection of the appropriate personal protection levels
- Correct use of personal protective equipment (PPE)
- Work practices to minimize risks from hazards
- Safe use of engineering controls and equipment on site
- Medical surveillance requirements, including recognition of symptoms and signs that might indicate over-exposure to hazardous substances

Copies of health and safety training records, including course completion certifications for the initial and refresher health and safety training, specialized supervisor training, and first aid and CPR training, are to be maintained in the project files.

In addition to the health and safety training, sampler(s) will be provided with field methods and sampling procedures outlined in this SAP. This training includes but is not limited to:

- Soil, sediment, debris, or water sampling as applicable to the project
- Sample handling, packaging, and shipping
- Use of related field equipment
- Handling of project-derived waste

If the project scope or type of sampling to be performed changes, the sampler(s) will be provided with additional training prior to field activities. All training will be documented, and the training record will be maintained in the project file. Sampling personnel will be required to read and understand the SAP, associated work plans, and TSPs prior to any sample collection activities. The project personnel sign-off sheet will be signed by any on-site personnel conducting sampling to indicate that they have read the SAP and will perform the task as described. The sign-off sheet will be maintained in the project file.

2.2.1 Specialized Training

In addition to the general training described above, the sampler(s) must receive general employee radiological training prior to any field activities. The specialized training requirements are listed in Table B.2-3.

TABLE B.2-1

PERSONNEL RESPONSIBILITIES AND QUALIFICATIONS
(UFP-QAPP Worksheet #7)

Name	Title	Organizational Affiliation	Responsibilities
Mr. Narciso Ancog	Quality Assurance Officer	NAVFAC SW	• Reviewing and approving Sampling and Analysis Plan • Providing DON oversight of TtEC's Quality Assurance Program • Providing quality-related directives through the Contracting Officer • Providing technical and administrative oversight of TtEC's surveillance audit activities • Acting as point of contact for matters concerning quality assurance and the DON's Laboratory Quality Assurance Program • Authorizing the suspension of project execution if quality assurance requirements are not adequately followed
Mr. Ralph Pearce	Remedial Project Manager	NAVFAC SW	• Performing project management for the DON • Ensuring that the project scope of work requirements are fulfilled • Overseeing the project cost and schedule • Providing formal technical direction to the TtEC project team, as needed • Acting as lead interface with agencies
Mr. William Dougherty	Project Manager	TtEC	• Coordinating work activities of subcontractors and TtEC personnel and ensuring that all personnel adhere to the administrative and technical requirements of the project • Monitoring and reporting the progress of work and ensuring that the project deliverables are completed on time and within project budget • Monitoring the budget and schedule and notifying the client and the RPM of any changes that may require administration actions • Ensuring adherence to the quality requirements of the contract, project scope of work, and the SAP • Ensuring that all work meets the technical requirements of TSPs and complies with applicable codes and regulations • Ensuring that all work activities are conducted in a safe manner in accordance with the HASP, USACE's *Safety and Health Requirements* (EM 385-1-1), and all applicable OSHA regulations

TABLE B.2-1

PERSONNEL RESPONSIBILITIES AND QUALIFICATIONS
(UFP-QAPP Worksheet #7)

Name	Title	Organizational Affiliation	Responsibilities
			• Serving as the primary contact between the DON and TtEC for actions and information related to the work and including appropriate TtEC technical personnel in the decision-making • Coordinating satisfactory resolution and completion of evaluation and acceptance report for Nonconformance Reports
Ms. Laurie Lowman	Radiological Site Manager	RASO	• Reviewing radiological laboratory data on a routine basis • Reviewing and approving on-site laboratory SOPs for each type of analysis performed • Performing on-site reviews of all radiological site operations including the on-site laboratory • Reviewing and approving TSPs and final reports • Performing quality reviews on COCs to ensure samples are handled in accordance with the Work Plan and SAP • Providing review and concurrence on data for proposed radiological actions • Ensuring that all necessary sample results are provided and are consistent with proposed radiological actions • Comparing radiological data with the requirements of the Work Plan, Task-specific Plans, and SAP to ensure that all proper conditions have been met to implement the action requested • Ensuring that the radiological data reported is consistent with the intent for which the data was provided • Comparing the sample number matrix with the intent of the data package to ensure that the sample number is consistent with the intent of the data package • Reviewing sample acquisition information to ensure that the duration the sample was analyzed for meets the minimum required time necessary to meet the MDA • Comparing each of the radionuclides' specific activity with the release criteria to ensure that the decision made is consistent with the specific activity reported • Comparing the MDA with the release criteria to ensure that it is sufficiently below the release levels • Evaluating the qualifiers provided in the sample results to ensure that the information provided is consistent with the results provided • Reviewing uncertainty counting and the 2 sigma total uncertainty data along with the laboratory qualifiers to determine if the data is of sufficient quality

TABLE B.2-1

PERSONNEL RESPONSIBILITIES AND QUALIFICATIONS
(UFP-QAPP Worksheet #7)

Name	Title	Organizational Affiliation	Responsibilities
Mr. Cliff Stephan	Radiation Safety Officer	TtEC	• Overseeing overall radiological operations and documentation for the project • Supporting projects as the technical lead for radiological data collection and analysis • Evaluating and selecting a qualified on-site laboratory • Ensuring that RSOR and PRSO have adequate training in sample collection and analytical methods • Monitoring performance of on-site radiological contractors • Monitoring performance of on-site laboratory • Ensuring that 10 percent of the samples are forwarded for off-site QA analysis • Receiving and reviewing the QA sample data from the off-site laboratory to ensure the data quality objectives have been met
Mr. Bert Bowers	Radiation Safety Office Representative	NWT	• Reviewing on-site laboratory data against requirements in this SAP prior to use • Assessing on-site data to ensure that the quality of the data meets the intended use of the data • Monitoring the gathering of field data by radiological technicians • Ensuring that the field sampling requirements of this SAP are followed explicitly • Assisting in the implementation of this SAP as directed by the PRSO
Mr. Daryl DeLong	Project Radiation Safety Officer	RSRS	• Providing overall day-to-day on-site radiological operations and documenting preparation activities • Reviewing on-site laboratory data against requirements in this SAP prior to use • Assessing on-site data to ensure that the quality of the data meets the intended use of the data • Reviewing and evaluating scan survey data and requiring additional scan data, as necessary • Overseeing performance of radiological surveys • Identifying and assessing radiological contamination • Concurring on the identification of elevated areas for collection of biased samples and the locations of systematic samples • Overseeing the preparation of a remediation plan and the performance of remedial activities when sampling activities indicate the presence of radioactive materials at levels above the release criteria • Directing any additional biased sampling activities to ensure the isolation and removal of radioactive material

TABLE B.2-1

PERSONNEL RESPONSIBILITIES AND QUALIFICATIONS
(UFP-QAPP Worksheet #7)

Name	Title	Organizational Affiliation	Responsibilities
			• Reviewing and evaluating biased sampling data and identifying any additional radiological activities • Recommending radiological activities to the RASO for concurrence • Overseeing the plotting of systematic sample locations and collection of the appropriate number of samples • Reviewing and evaluating static survey readings used to verify scan surveys or to get a reading of a sampling point • Performing periodic on-site review of laboratory operations • Reviewing sample data to ensure the appropriate information is included in the gamma spectroscopy reports • Consulting with the on-site Laboratory Project Manager regarding his assessment of the spectrum provided with the analyses and other issues • Directing the on-site laboratory to analyze samples for longer periods to ensure the sample data results are correct, the MDA is below the release criteria, and/or the uncertainty is within tolerance, as appropriate • Directing the on-site laboratory to perform additional types of analyses (i.e., ^{90}Sr or alpha spectroscopy) • Comparing the laboratory results to the appropriate release criteria for the site • Identifying samples to be forwarded to the off-site laboratory for QA purposes • Reviewing the QA sample data from the off-site laboratory to ensure the data quality objectives have been met and requesting additional information, as necessary
Mr. Paul Wall	On-site Laboratory Project Manager	NWT	• Providing day-to-day technical and administrative oversight of the on-site radiological laboratory • Reviewing on-site laboratory sample results • Developing and implementing on-site laboratory SOPs • Reviewing sample counting results prior to sending the samples off-site • Overseeing performance of gamma spectroscopy, ^{90}Sr, and alpha spectroscopy analyses for the on-site laboratory • Ensuring that samples are properly prepared for the appropriate analysis in the on-site laboratory • Ensuring that all detectors and equipment are properly maintained and calibrated, as necessary

TABLE B.2-1

PERSONNEL RESPONSIBILITIES AND QUALIFICATIONS
(UFP-QAPP Worksheet #7)

Name	Title	Organizational Affiliation	Responsibilities
			• Overseeing the MDA calibration geometry, system and source-induced backgrounds, and detector resolution and ensuring that it is appropriate for each radionuclide • Reviewing gamma spectroscopy analytical result reports to ensure that the MDAs are below the release criteria, that the counting uncertainties are within tolerance of the reported activity, and that the flags associated with each report represent a clear understanding of the associated reported activity for the isotope in question • Verifying each analytical result by reviewing the spectrum file associated with each report • Ensuring that the electronic and hard copies of the analytical summary reports are delivered to TtEC for review • Reviewing the QA sample data from the off-site laboratory to ensure that the data quality objectives have been met
Mr. John Polyak	Radiation Task Manager	NWT	• Providing day-to-day technical and administrative oversight of NWT radiological operations • Reviewing scan survey data prior to it being sent to the Project Radiation Safety Officer for further review and evaluation and requiring additional scan data, as necessary • Ensuring that all radiological detectors are functioning properly • Performing sampling activities as directed by the PRSO • Reviewing and evaluating static survey readings used to verify scan surveys or to get a reading of a sampling point • Performing periodic reviews of on-site laboratory operations • Ensuring that all laboratory equipment is properly maintained and repaired • Ensuring that laboratory supplies are available on site and that expiration dates are observed

TABLE B.2-1

PERSONNEL RESPONSIBILITIES AND QUALIFICATIONS
(UFP-QAPP Worksheet #7)

Name	Title	Organizational Affiliation	Responsibilities
Mr. Greg Joyce	Quality Control Program Manager	TtEC	• Establishing and maintaining the Quality Program • Overseeing program QC, including construction and chemical data acquisition • Acting as a focal point for coordination for quality matters across all projects and resolving quality issues • Suspending project activities if quality standards are not maintained • Interfacing with the DON, including NAVFAC SW Quality Assurance Officer, on quality-related items • Conducting field QC audits to ensure that project plans are being followed • Performing reviews of audit and surveillance reports conducted by others • Ordering analysis of Performance Evaluation samples by the on-site laboratory as appropriate • Implementing DON technical direction letters related to quality topics
Ms. Lisa Bienkowski	Program Chemist	TtEC	• Implementing contract requirements for data collection • Supporting projects as the technical lead for data collection and analysis • Ensuring that Project Chemist has adequate training in sample collection and analytical methods • Monitoring performance of off-site laboratory and data validation subcontractors
Ms. Sabina Sudoko	Project Chemist	TtEC	• Developing the SAP • Ensuring that sampling personnel have documented training on sampling procedures for specific project requirements • Evaluating and selecting a qualified off-site laboratory • Reviewing off-site laboratory data against requirements in this SAP prior to use • Evaluating and selecting a qualified data validation subcontractor • Reviewing data validation reports • Assessing off-site data to ensure that the quality of the data meets the intended use of the data

TABLE B.2-1

PERSONNEL RESPONSIBILITIES AND QUALIFICATIONS
(UFP-QAPP Worksheet #7)

Name	Title	Organizational Affiliation	Responsibilities
Mr. Jon Karnath	Data Manager	TtEC	• Uploading field information and laboratory data into the database • Checking all data for completeness such that all required fields are entered and providing output to the project team in the format requested • Submitting NEDD formatted data to the DON in accordance with the requirements set forth in *Environmental Work Instruction (EWI) EVR.6, Environmental Data Management and Required Electronic Delivery Standards* (NFECSW, 2005)

Abbreviations and Acronyms:

^{90}Sr – strontium-90
COC – chain of custody
DON – Department of the Navy
EM – Engineering Manual
EWI – Environmental Work Instruction
HASP – Health and Safety Plan
MDA – minimum detectable activity
NAVFAC SW – Naval Facilities Engineering Command, Southwest
NEDD – Navy electronic data deliverable
NFECSW –Naval Facilities Engineering Command – Southwest
NWT – New World Technologies, Inc.
OSHA – Occupational Safety and Health Administration
PRSO – Project Radiation Safety Officer
QA – quality assurance
QC – quality control
RASO – Radiological Affairs Support Office
RPM – Remedial Project Manager
RSOR – Radiation Safety Office Representative
RSRS – Radiological Survey and Remedial Services, LLC
SAP – Sampling and Analysis Plan
SOP – Standard Operating Procedure
TSP – Task-specific Plan
TtEC – Tetra Tech EC, Inc.
UFP-QAPP – Uniform Federal Policy for Quality Assurance Project Plans
USACE – United States Army Corps of Engineers

TABLE B.2-2

COMMUNICATION PATHWAYS
(UFP-QAPP Worksheet #6)

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure
Notice to proceed	NAVFAC RPM	Mr. Ralph Pearce	(619) 532-0912	NAVFAC RPM will review and approve project work plans, and communicate directly with Tt PjM on all aspects of project management. NAVFAC RPM will also coordinate with appropriate NAVFAC personnel in the event that changes require additional approvals or authorizations.
SAP approval	NAVFAC SW QAO	Mr. Narciso Ancog	(619) 532-3046	NAVFAC SW QAO will review and approve SAP. Field sampling will not begin without approved SAP.
Project management	Project Manager (PjM)	Mr. William Dougherty	(415) 216-2731	If changes are necessary, the PjM is responsible for communicating the changes via phone and/or e-mail to the project staffs and is authorized to stop work if necessary.
SAP review and radiological concurrence	RASO	Ms. Laurie Lowman	(757) 887-4692	The RASO will review and concur on the SAP as related to the radiological aspects of the site.
SAP review	Program Chemist	Ms. Lisa Bienkowski or Mr. Greg Joyce	(949) 756-7592 (360) 598-8117	SAP will be reviewed by the Program Chemist (or QCM) prior to submittal to the NAVFAC SW QAO.
Coordination of off-site laboratory supplies for field activities	Project Chemist	Ms. Sabina Sudoko	(949) 756-7545	The Project Chemist or designee will contact the off-site laboratory to provide all necessary sample containers and appropriate shipping materials (such as coolers and bubble wrap) to be delivered on site prior to commencement of field sampling activities and throughout the course of the project.
Submittal of samples to the on-site laboratory	Sampling Personnel	New World Technologies, Inc.	(415) 216-2739	Sampler will transfer samples to the on-site laboratory at the end of each day.
Daily COC reports and shipping documentation for off-site samples (radiological samples)	Radiation Task Manager	Mr. John Polyak	(415) 216-2732	COCs and shipping documentation will be submitted via fax or e-mail to the Project Chemist at the end of each day that samples are collected for radiological analytes.
Daily COC reports and shipping documentation for off-site samples (non-radiological samples)	Project Manager	Mr. William Dougherty	(415) 216-2731	COCs and shipping documentation will be submitted via fax or e-mail to the Project Chemist at the end of each day that samples are collected for non-radiological analytes.
Reporting laboratory data quality	Laboratory Project	Mr. Paul Wall	(415) 216-2739	All QA/QC issues will be reported by the Laboratory Project

TABLE B.2-2

COMMUNICATION PATHWAYS
(UFP-QAPP Worksheet #6)

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure
issues	Manager (on-site laboratory) Laboratory Project Manager (off-site laboratory)	Ms. Melissa Mannion	(510) 235-3633	Manager to the Project Chemist or PRSO in writing within 2 business days.
Field and analytical corrective actions	Project Chemist (off-site laboratory) PRSO (on-site laboratory)	Ms. Sabina Sudoko Mr. Daryl DeLong	(949) 756-7545 (415) 216-2734	The Project Chemist or PRSO will notify the PQCM, QCM, Program Chemist, RASO, and RSO in writing of any field or analytical procedures that were performed not in accordance with this SAP immediately. The Project Chemist or PRSO in coordination with the PQCM will complete documentation of the non-conformance and corrective actions to be taken. The Project Chemist or PRSO will verify that the corrective actions have been implemented.
Release of analytical data	Project Chemist (off-site laboratory) PRSO (on-site laboratory)	Ms. Sabina Sudoko Mr. Daryl DeLong	(949) 756-7545 (415) 216-2734	The Project Chemist or PRSO will review data to verify that data quality is met as described in this SAP prior to releasing the data. Analytical data will be released to the Project Manager (or their designee) after the Project Chemist or PRSO has verified that the data is in accordance the SAP requirements.
Review of radiological data and concurrence on radiological actions	RASO	Ms. Laurie Lowman	(757) 887-4692	The RASO will review all appropriate radiological data provided by the PRSO or designee and will concur on actions proposed by the PRSO.
SAP procedure revision during field activities	Project Chemist	Ms. Sabina Sudoko	(949) 756-7545	The Project Chemist or designee will prepare an FCR for any changes in sampling procedures that occur due to conditions in the field.
SAP amendments	Project Chemist	Ms. Sabina Sudoko	(949) 756-7545	Any changes to the SAP will require that the Project Chemist or designee prepare an addendum that will be approved by NAVFAC SW QAO prior to any field activities.

TABLE B.2-2

COMMUNICATION PATHWAYS
(UFP-QAPP Worksheet #6)

Abbreviations and Acronyms:

COC – chain of custody
FCR – Field Change Request
NAVFAC SW – Naval Facilities Engineering Command, Southwest
PjM – Project Manager
PQCM – Project Quality Control Manager
PRSO – Project Radiation Safety Officer
QA – quality assurance
QAO – Quality Assurance Officer
QC – quality control
QCM – Quality Control Program Manager
RASO – Radiological Affairs Site Office
RSO – Radiation Safety Officer
SAP – Sampling and Analysis Plan
UFP-QAPP – Uniform Federal Policy for Quality Assurance Project Plans

TABLE B.2-3

SPECIAL PERSONNEL TRAINING REQUIREMENTS
(UFP-QAPP Worksheet #8)

Project Function	Specialized Training – Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records and Certificates
Soil/sediment sampling	General employee radiological training	RSO, RSOR, PRSO or their designee	Prior to field work	Sampling personnel	RSO, TtEC PRSO, RSRS Sampler, NWT	TtEC project file
Swipe sampling	On-site demonstration	RSOR or their designee	Prior to sampling activities	Sampling personnel	Sampler, NWT	TtEC Project file
Sampling handling, documentation, and packaging procedures	On-site demonstration	RSO, RSOR, PRSO or their designee	Prior to sampling activities	Sampling personnel	Sampler, TtEC Sampler, NWT	TtEC Project file

Abbreviations and Acronyms:

NWT – New World Technologies, Inc.
PRSO – Project Radiation Safety Officer
RSO – Radiation Safety Officer
RSOR – Radiation Safety Office Representative
TtEC – Tetra Tech EC, Inc.
UFP-QAPP – Uniform Federal Policy for Quality Assurance Project Plans

3.0 PROJECT OVERVIEW

This section describes the project background, scope, and DQOs.

3.1 BACKGROUND

Site location, description, and history are detailed in Section 2.0 of the Base-wide Radiological Work Plan Revision 1 (Base-wide Plan) and the HPS Historical Radiological Assessment (NAVSEA, 2004).

3.2 SCOPE

The general approach to survey of each building and site will be documented in the applicable TSP prepared under the Base-wide Plan, and this SAP.

3.3 DATA QUALITY OBJECTIVES

MARSSIM recommends using the seven-step DQO process in the design of radiological surveys. This process tailors the survey to the particular conditions around each survey situation. This section summarizes DQO elements applicable to most of the surveys to be performed under this plan. Specific DQOs for each survey will be established in the relevant TSPs.

3.3.1 State the Problem

The first step in the DQO process is to simply state the problem. The problem is, "Existing data is not sufficient to support release of impacted areas at HPS."

A scoping survey is needed to provide data to plan the release or remediation of a building or area.

A characterization survey is needed to provide additional data to plan the release or remediation of a building or area.

A remedial action support survey is needed to provide data while implementing the remediation of a building or area.

A Final Status Survey (FSS) is needed to provide data for free release of a building or area.

3.3.2 Identify the Goals of the Study

For a scoping survey, the decision is, "Does the survey defined in the TSP identify the radionuclides of concern and assess general levels and extent of contamination?"

For a characterization survey, the decision is, "Does the survey information defined in the TSPs identify the nature and extent of the contamination that may lead to remediation?"

For a remedial action support survey, the type of decision is, "Does the remedial action support survey indicate that the remediation is complete (as defined in the TSPs)?"

For an FSS, the decision is, "Do the FSS results demonstrate compliance with the release criteria?"

3.3.3 Identify Information Inputs

Inputs will vary, depending on the specific survey, and will be detailed in the TSP. However, in general, some or all of the following data will be used.

- Gamma scan survey
- Alpha/beta scan surveys
- Systematic and biased static alpha, beta (buildings and structures), and gamma static readings
- Systematic and biased solid and smear sampling
- Systematic and biased exposure rate measurements

For a scoping survey, additional inputs to the decision are the information in the HRA and the radiological survey data collected during the implementation phase.

For a characterization survey, additional inputs are again the information in the HRA and the radiological survey data collected during the implementation phase.

For a remedial action support survey, additional inputs are the results of prior surveys and the specific remediation plans.

For an FSS, additional inputs are the radiological survey results and the release criteria.

3.3.4 Define Boundaries of the Study

Study boundaries will depend on the particular survey performed. For a building or land area, it will be the physical boundaries of those spaces. For remedial action support surveys, it will be the extent of the remedial action work area and associated support areas. Study boundaries will be presented, on a case-by-case basis, in TSPs.

3.3.5 Develop the Analytical Approach

For each applicable survey, developing a decision rule is as follows:

- For a scoping survey, the decision rule is, "If the survey results meet the criteria defined in the TSPs, then design and perform an optimized FSS. If the survey results do not meet the criteria defined in the TSPs, then design and perform an optimized characterization survey."

- For a characterization survey, the decision rule is, "If the survey results meet the criteria and data quality objectives defined in the TSPs, then design and perform an optimized FSS. If the survey results do not meet the criteria and data quality objectives defined in the TSPs, then perform remedial action."
- For a remedial action support survey, the decision rule is, "If the survey results indicate that the remediation is complete (as defined in the TSPs), then design and perform an optimized FSS. If the survey results indicate that the remediation is incomplete, then re-evaluate the remedial alternative and continue remediation if necessary."
- For an FSS, the decision rule is, "If the survey results demonstrate compliance with the release criteria, then document the results in the FSS report. If the survey results do not demonstrate compliance with the release criteria, then additional assessment and/or remediation are necessary."

The release criteria for buildings, structures, material, and land areas at HPS are listed in Section 6.0 of the Base-wide Plan. Limits for a specific building, area or for multiple radionuclides will be given in the TSPs.

In evaluating this decision, unless otherwise indicated in the TSPs, MARSSIM Scenario A will be applied. In Scenario A, the null hypothesis (H_o) is tested that residual contamination exceeds the release criterion; also, the alternative hypothesis (H_a) is tested to determine if the residual contamination meets the release criterion. Details on the null hypothesis are given in Section 3.3.6.

3.3.6 Specify Performance or Acceptance Criteria

For those surveys where decision errors would be used, there are two types of decision errors that can be made. The first type of decision error, called a Type I error, occurs when the null hypothesis is rejected when it is actually true. A Type I error is sometimes called a "false positive." The probability of a Type I error is usually denoted by α. The Type I error rate is often referred to as the significance level or size of the test.

The second type of decision error, called a Type II error, occurs when the null hypothesis is not rejected when it is actually false. A Type II error is sometimes called a "false negative." The probability of a Type II error is usually denoted by beta (β).. The *power* of a statistical test is defined as the probability of rejecting the null hypotheses when it is false. It is numerically equal to $1-\beta$, where β is the Type II error rate.

This survey is designed to limit Type I and Type II errors to 5 percent, except when double sampling is used where the Type I error rate is set to a maximum of 2.5 percent. It is important to minimize the chances of concluding that a survey unit meets the release limits (reject the null hypothesis) when it actually exceeds the limits (Type I error) and of concluding that a survey unit exceeds the release limit (accept the null hypothesis) when it actually meets the limit (Type II error).

3.3.7 Develop the Plan for Obtaining Data

Guidelines for optimizing the data collection process are presented below:

- Review Outputs and Existing Data for Consistency

  Radioactive source readings will be used to check instruments for consistency prior to use in each daily shift. The instrument will only be used after readings are compared and agree within +/- 20 percent of predetermined responses. The RTM (or designee) will review the information each day to verify that equipment is operating satisfactorily.

  The RTM, or qualified designee, who is not involved in the direct data collection process will review the survey data on a daily basis. This will ensure an ongoing independent review for consistency of survey data collected.

- Develop Data Collection Design Alternatives

  The MARSSIM guidelines will be used and a 95 percent confidence level for detecting radioactivity above the release criteria will be assumed with Type I and Type II errors limited to 5 percent (except when double sampling is used when the Type I error will be set to a maximum of 2.5 percent).

- Document Operational Details and Theoretical Assumptions

  Operational details for the radiological survey process have been developed for and are included as part of the Base-wide Plan. The theoretical assumptions are based on guidelines contained in MARSSIM. General information regarding types of radiation measurements, instrument-detection capabilities, selecting the quantities and locations of data to be collected, investigation levels, and release criteria are contained in the Base-wide Plan. Site-specific operational details and theoretical assumptions will be identified in relevant TSPs.

4.0 DOCUMENTATION AND RECORDS

This section discusses the types of documentation and records required for this project and Table B.4-1 lists where the documentation and records will be maintained.

4.1 FIELD DOCUMENTATION

Field documentation associated with sampling activities includes logbooks, field forms, sample labels, chain-of-custody (COC) records, field surveillance reports, and Field Change Request (FCR) forms. Descriptions of each type of field documentation are described in the following sections.

4.1.1 Logbooks

A permanently bound field logbook with consecutively numbered pages, used for sampling activities only, will be assigned to this project. All entries will be recorded in indelible black or blue ink. At the end of each work day, the logbook pages will be signed by the responsible sampler and any unused portions of the logbook pages will be crossed out, signed, and dated. If it is necessary to transfer the logbook to another person, the person relinquishing the logbook will sign and date the last page used and the person receiving the logbook will sign and date the next page to be used. At a minimum, the logbook will contain the following information (as appropriate):

- Project name and site location
- Date and time
- Personnel in attendance
- General weather information
- Work performed
- Field observations
- Sampling performed, including specifics such as location, type of sample, type of analysis, and sample identification
- Field analyses performed, including results, instrument checks, problems, and calibration records for field instruments
- Problems encountered and corrective action taken
- Identification of field QC samples (as applicable)
- QC activities
- Verbal or written instructions
- Any other events that may affect the samples

In addition to the field logbook, a spreadsheet (Sample Status Log) may be used in the field to record sample information.

4.1.2 Field Forms

Field forms required for this project will include COC forms. The COC forms are described in Section 4.1.4 and a sample COC form can be found in Attachment 1.

4.1.3 Sample Labels

Sample labels are necessary to prevent misidentification of samples. Sample labels typically will be computer-generated at the time the COC is prepared and produced by the approved TtEC COC database program.

Sample label data that can only be completed by a sampler in the field (i.e., time of collection) will be filled out in indelible black or blue ink and affixed to sample containers at the time of sample collection. An example sample label is provided in Attachment 1. Each sample label will be covered with clear tape (pressure-sensitive box tape) for soil samples. For swipe samples, the label will be indicative of the specific area under study (typically a survey unit), and will be attached to the bag containing the swipes from this area, with each individual swipe inside the bag sequentially numbered to indicate the sampling location. At a minimum, each sample container will be labeled with the following:

- Sample identification number
- Sample collection date (month/day/year)
- Time of collection (24-hour clock) from the start of sampling
- Sampler's initials
- Preservative (if any)
- Sample weight (data completed by laboratory)

When a plastic bag is used to collect samples (i.e., sediment or soil) for radiological analysis, then the sample bag will be directly marked with indelible ink. If this sample is then transferred to a container, the lid of the container will be labeled. If containers are too small to fit all of the above-listed sample information, at a minimum, the container will be labeled with the designation of the consecutive sample number.

4.1.4 Chain of Custody

An overriding consideration for data resulting from laboratory analyses is the ability to demonstrate that the data are legally defensible, i.e., that the samples were obtained from the locations stated and that they reached the laboratory without alteration. To accomplish this, evidence of collection, shipment, laboratory receipt, and laboratory custody until disposal will be documented through the COC record.

A sample is considered to be in custody if the following conditions have been observed:

- In actual possession or in view of the person who collected the samples
- Locked in a secure area
- Placed in an area restricted to authorized personnel
- Placed in a container and secured with an official seal, such that the sample cannot be reached without breaking the seal (custody seals will not be used for radiological samples collected, as the seal would interfere with the analysis since the container may be placed on the instrument)

To establish the documentation necessary to trace sample possession from the time of collection through analysis, the COC record will be completed and will accompany every sample. Typically, the COC will be prepared and produced by the approved TtEC COC database program prior to sample collection. Exceptions to the use of the COC database program are limited and may include sediment or ventilation samples collected in the field, but will have the RSO or PRSO concur upon their use. Attachment 1 presents an example of the COC record. The COC record lists each sample and the individuals performing the sample collection, shipment, and receipt. Attachment 1 also presents an example of a custody seal that will seal samples and the cooler during transportation to the off-site laboratory.

The COC record will be the controlling document to ensure that sample custody is maintained. The COC record will be initiated by the TtEC COC database program prior to sampling in the field with the exception of ventilation and sediment samples, which will be initiated by sampling personnel in the field. Sampling personnel upon collecting a sample will complete the COC record in the field. Each time the sample custody is transferred, the former custodian will sign the COC on the "Relinquished By" line, and the new custodian will sign the COC on the "Received By" line. The date, time, and the name of their project or company affiliation will accompany each signature.

The waybill number and courier name will be recorded on the COC when a commercial carrier is used to transport samples to the off-site laboratory. The shipping container will be secured with two custody seals, thereby allowing for custody to be maintained by the shipping personnel until receipt by the off-site laboratory.

Sample custody will be the responsibility of sampling personnel from the time of sample collection until the samples are accepted by the on-site laboratory or either the commercial courier or laboratory-provided courier for samples sent off-site. After samples are received by the laboratory, custody of samples will be the responsibility of the laboratory staff in accordance with the laboratory Standard Operating Procedures (SOP).

In addition to providing a custody exchange record for the samples, the COC record serves as a formal request for sample analyses. The completed COC records will be processed as follows:

- Two copies will be sent to the on-site or off-site laboratories with the samples. The laboratory will include one copy in with the data packages submitted to TtEC.
- The third copy will be retained on site in the TtEC project file.
- The last copy will be sent to the Project Chemist (off-site laboratory) and PRSO (on-site laboratory).

If additional analyses are performed by the on-site laboratory due to the results of another analysis, then the COC will be modified to indicate the additional analyses performed, and all other copies of the COC will also be modified.

4.1.5 Supplies Certification

Certificates from the supplier demonstrating that containers for sampling, deionized water for decontamination, and laboratory-grade water for rinsate samples are analyte-free will be provided for each lot, as appropriate. In addition, a certificate will accompany any calibration gases for field screening instruments to ensure that gases are the manufacturer's specified grade. Certificates will be placed in the project files.

Deionized water made by the on-site laboratory will be considered acceptable if the SOP that governs the processing of deionized water was followed; the on-site laboratory should keep records to the same indicating the date and time the process was performed, and the initials of the technician who performed the process.

4.1.6 Sample Shipping Records

Samples will be transported to the laboratory via hand delivery, laboratory-provided courier, FedEx®, UPS®, or DHL® (which may be referred to generically as a commercial carrier). For samples received via hand delivery or laboratory courier, the person transporting the samples will sign the COC and accept the samples. For samples shipped via commercial carrier, the COC will be included in the cooler, and the sender's copy of the airbill will serve as custody documentation and will be maintained on site in the project file. Specific information on sample handling and shipping procedures is detailed in Section 6.6. Radioactive sample shipment by common carrier will be performed in accordance with United States Department of Transportation and/or International Air Transport Association regulations for such shipments, as appropriate.

4.1.7 Field Surveillance Reports

An on-site field inspection will be performed by the Project Quality Control Manager (PQCM) and RSO at a frequency of once at the beginning of the first field sampling activity, semiannually, and once near the end of sampling activities. Sampling activities performed under

this section are considered an aggregate of any sampling activity, performed under any TSP. The PQCM and RSO will use the surveillance checklist during inspection. Surveillance reports will be prepared and provided to the Project Manager (PjM) and QCM.

4.1.8 Field Change Request

An FCR will be prepared by the Project Chemist or designee if a change to the SAP occurs during the project. Major changes to work scope affecting the original DQOs or meeting criteria described in *EWI #2, 3EVR.2, Review, Approval, Revision, and Amendment of Sampling and Analysis Plans (SAPs)* (NAVFAC SW, 2006) will require preparation of a SAP addendum. The SAP addendum must be approved by the NAVFAC SW QAO prior to conducting sampling and analysis.

4.2 LABORATORY DOCUMENTATION

Off-site and on-site laboratory records associated with project samples include the following at a minimum as applicable:

- Sample receipt and login
- Laboratory-internal COC
- Instrument calibration logs
- Sample preparation logs
- Sample analysis/run logs
- Sample results
- Case narrative
- NCRs including corrective actions

The laboratory will prepare analytical data packages comprised of documentation mentioned above for each sample as applicable and provide them to TtEC. Off-site laboratory deliverables will include two copies of the hard-copy data package, submitted as either EPA Level III-equivalent or IV-equivalent packages as specified in the COC. Detailed information on the requirement of the hard-copy data package is presented below.

The pages in the data package will be sequentially numbered. The package will contain a table of contents referencing individual sections, the original of COC records, a copy of all corrective action reports, and a narrative documenting the resolution of all corrective actions and nonconformances. All samples will be cross-referenced to the associated QC samples. The packages will be assembled in the following sequence:

- Cover page (with laboratory name, address, phone number, contact person, and sample delivery group number, as well as project name and project number)

- Table of contents
- Case narrative
- Sample management records including the original copy of COC records (including cooler temperature and sample condition), shipping documents, and laboratory sample receipt forms
- Cross-reference table
- Analytical results and QA/QC information by test as follows:
  - Radiological raw data sequence
    - Sample results forms, including method blanks
    - Sample raw data (EPA Level IV only)
    - QC summaries
    - Initial calibration (ICAL)
    - Calibration checks, including all related continuing calibration verifications (CCVs)
    - Instrument run log
    - Sample preparation log

All relevant laboratory raw data and documentation, including, but not limited to, logbooks, data sheets, electronic files, and final reports, will be maintained by the laboratory for at least 7 years. TtEC will be notified 30 days before disposal of any relevant laboratory records.

In addition to the hard-copy data, an electronic data deliverable (EDD) will be submitted in ASCII format from the off-site laboratory. The EDD will be compatible with the Navy electronic data deliverable (NEDD) standard. The laboratory will verify that the EDD and the hard-copy reports are identical. Both the EDD and the hard-copy report will present results to two or three significant figures. For radiological results, at least three significant figures will be used for all results. Results for QC analyses (method blanks, matrix spike/matrix spike duplicate [MS/MSD], laboratory control sample/laboratory control sample duplicate [LCS/LCSD]) will be reported up to three significant figures. The EDD for each sample delivery group is due at the same time as the hard-copy reports, 30 calendar days after the last sample of the sample delivery group has been delivered to the laboratory. Due to the amount of time required for some radiological analyses, the 30 calendar days may be extended up to 60 calendar days with the prior concurrence of the PjM.

The on-site laboratory will submit an electronic spreadsheet file or equivalent of the results of the radiological analysis.

When revisions to data reports are required, the revised pages will be stamped with the notation "amended or revised report." If revisions affect the EDD or electronic spreadsheet file, then a revised EDD or electronic spreadsheet file must be sent along with the revised hard-copy pages.

4.3 DATA VALIDATION REPORTS

All analytical data generated from the off-site laboratories, with the exception of chemical waste characterization samples, will be validated by an independent data validation company. In addition, data for samples analyzed by the on-site laboratory and then sent to the off-site laboratory for QA purposes will also be validated. The validator shall provide one original and one copy of the Data Validation Reports, which include analytical result pages with appropriate qualifiers and the Data Validation Findings Worksheets. The original and copy reports will be submitted in separate sets. The reports will be arranged in increasing sample delivery group (SDG) numbers and grouped by the type of analysis; i.e., a group of reports will consist of SDGs with the same analysis arranged in increasing numerical order. Each SDG will be submitted as a separate data validation report. SDG numbers are unique and will not be repeated.

The validation reports will contain the following information:

- Title page, which includes project name, sample collection date, validator subcontractor name, report date, type of analysis, laboratory, SDG, sample identifications (including MS/MSD, duplicate, reanalysis, or dilution samples), sample matrix (e.g., soil, water), and validation level (EPA Level III or IV)
- Introduction page, which includes the number of samples per matrix, analytical method reference, validation guideline reference, section references to summary qualification flags, and denotes QC samples; statements regarding flag classification (protocol/advisory) and whether raw data check was performed
- Section headings for each analytical method will include:
  - Technical holding times
  - Gas chromatography/mass spectrometer (GC/MS) instrument performance check (tune) (if applicable)
  - Calibration
    a. ICAL
    b. Initial calibration verification (second source standard)
    c. CCV
  - Laboratory blanks
  - Accuracy and precision data
    a. Surrogate spike recoveries
    b. MS/MSD
    c. LCSDs
    d. Internal Standards
  - Target compound identification
  - System performance checks
  - Analyte quantitation and quantitation limits (QLs)
  - Field QC samples (if not applicable, report will note)

  - Overall assessment of data
  - Assessment of compliance with scope of work (SOW) requirements
- QC deviation summaries, which will include in a tabular format:
  - Unique identification of QC run (e.g., date/time, etc.)
  - Associated project and sample numbers (not the laboratory-internal sample IDs)
  - Associated constituents
  - Actual value for noted deviation
  - Applicable QC criteria
  - Applicable qualifiers
  - Qualifier classifications (advisory or protocol)
- Copies of analytical result pages, which will be flagged with the appropriate changes in results/qualifiers based on the data validation findings; with each analytical result page with changes initialed and dated; and analytical result pages still included if there are no changes in results/qualifiers.
- Validation findings worksheets
- Qualifier classification

The following format will be used when preparing and submitting revised data validation reports and analytical result pages:

- The cover letter and revised text pages will clearly identify the revision number (i.e., **Revision 1**) typed in the upper right-hand corner of the page.
- A statement in the cover letter will be included indicating that an asterisk will be placed in the margin to the left of any revised item in the text.
- Every revised page in the text will have the following statement placed at the bottom of the page:

  ***Indicates revision based on report review**.
- The summary table will have an asterisk placed to the left of every revised item and a statement at the bottom of the page as follows:

  ***Indicates change as a result of report review.**
- The analytical result pages will be stamped as follows:

  ***Indicates change as a result of report review.**

Revisions will be submitted within one week of receiving the review comments from the Project Chemist. Report revision submittal packages will include an original and copy of the cover page, revised pages, and revised analytical result pages.

The data validation subcontractor will maintain validation records for at least seven years. TtEC will be notified 30 days before disposal of any relevant records.

TABLE B.4-1

PROJECT DOCUMENTS AND RECORDS
(UFP-QAPP Worksheet #29)

Document	Where Maintained
Field logbooks	Project file
Field forms	Project file
Chain of custody	Project file
Shipping records	Project file
Field surveillance reports	Project file
Daily on-site laboratory results package including: • Copy of chain of custody • Sample results • Control check standard per batch • Laboratory duplicate results • Laboratory signed review page	Laboratory and project file; project file copy will subsequently be sent to NAVFAC SW Administrative Record
On-site laboratory data package for 10 percent of field status survey samples sent to off-site laboratory for QA analysis: • Copy of chain of custody • Instrument calibration information • Sample results • Control check standard per batch • Laboratory duplicate results • Associated raw data spectral analysis per sample • Laboratory signed review page	Laboratory and project file; project file copy will subsequently be sent to NAVFAC SW Administrative Record
Off-site laboratory data package including: • Copy of chain of custody • Sample receipt and login • Laboratory internal chain of custody • Instrument calibration information • Sample preparation logs • Sample analysis/run logs • Nonconformance Reports including corrective actions • Laboratory signed review page	Laboratory and project file; project file copy will subsequently be sent to NAVFAC SW Administrative Record
Data validation report	Validator and project file; project file copy will subsequently be sent to NAVFAC SW Administrative Record

Abbreviations and Acronyms:

NAVFAC SW – Naval Facilities Engineering Command, Southwest
QA – quality assurance
UFP-QAPP – Uniform Federal Policy for Quality Assurance Project Plans

5.0 SAMPLING STRATEGY

This section provides a brief description of the approach that will be used to collect samples. Table B.5-1 provides a summary of the sampling locations, matrix, depths, and analytical requirements. The analytical methods used for this project will be in conjunction with the *Gamma Emitting Radionuclides by Gamma Ray Spectroscopy, Prescribed Procedures for Measurement of Radioactivity in Drinking Water (EPA/600/4-80-032)* (EPA, 1980).

5.1 BACKGROUND (REFERENCE) SAMPLING

Prior to starting radiological surveys, an average background level may be determined by performing a required number of measurements at systematic or random locations within a designated background area as described in each TSP (as applicable). Some solid samples may be collected in the background area for comparative analyses of sample analyses as directed by the RSO, PRSO or TSP; additional background samples may be collected at the discretion of, or by direction from the Radiological Site Manager. The soil samples will be collected in the background area at systematic locations and analyzed by the on-site laboratory by gamma spectroscopy to establish average background values for the ROC, which will be used in conjunction with the RRO listed in the AM. Data collected in reference areas will be statistically evaluated using a graphical format, such as a frequency distribution chart. The purpose of the evaluation is to ensure that the data collected in the reference area are consistent with a normal distribution and that the variability of the background is not too high. Additional analyses may be performed on these reference area samples as detailed in the applicable TSP. Ten percent of the reference area samples shall be sent to an offsite laboratory for QA purposes and counted in the cumulative number of samples processed by the onsite laboratory. This requirement shall apply specifically to the background (reference) area in addition to the samples collected during scoping, characterization, remedial action support, and final status surveys.

5.2 MEDIA SAMPLING

Media sampling will be performed as detailed in the applicable TSP. Media samples consists of the following, but is not limited to:

- Soil and sediment
- Solid material of concrete, brick, porcelain, and wood
- Water from sinks, drain piping, sewer systems, rinsate, and low-point accumulation areas inside of buildings

Media samples will be analyzed by the on-site radiological laboratory. A minimum of 10 percent of the samples analyzed by the on-site radiological laboratory will be randomly selected and sent to an off-site laboratory for QA purposes. The PRSO or designee may select additional

samples for off-site analysis for QA purposes, if appropriate. Data from the on-site and off-site gamma spectroscopy analysis will be compared if minimum detectable activity (MDAs) and count times are within 20 percent of each other. Acceptance criteria of relative percent difference (RPD) for each pair is established at 30 percent. If the RPD is not within the established acceptance criteria, then the RASO and the DON will be notified and corrective actions will be identified and implemented. If on-site and off-site gamma spectroscopy analysis MDAs and count times are not within 20 percent of each other, the data will be evaluated as determined to be appropriate by the on-site Laboratory Project Manager.

5.3 SWIPE SAMPLING

Swipe samples will typically be collected over locations where static measurements were obtained to determine the fraction of removable activity present, relative to the total activity. Swipes typically will be analyzed with an ultra-low background gas-proportional counting apparatus, using a RASO-approved subcontractor SOP. If swipe media are analyzed using a different method, such as by gamma spectroscopy, then the RSO and PRSO should be notified. Any alternate method used will be previously approved by RASO, to ensure that the intent of the analysis is met.

Swipe samples will not be sent to an off-site laboratory, unless directed by the RSO or PRSO. There is no RPD requirement for these media, and duplicates will not be ordinarily performed.

5.4 WASTE CHARACTERIZATION SAMPLING

Wastes that will be generated during excavation activities include low-level radioactive waste (LLRW) and/or low-level mixed waste of soil, sediment, debris, and wastewater. Non-radiological generated waste may include soil and sediment, debris, and wastewater.

Soil/sediment and debris identified as radioactively contaminated will be stored in B-25 boxes or bins approximately 14 cubic yards in size and will be sampled to characterize the soil/sediment for disposal. At least one sample will be collected and analyzed by gamma spectroscopy by the on-site laboratory for each waste type placed in the bin and the results will be provided to the radiological waste contractor under the direction of the DON LLRW Disposal Program.

Drums, bottles, jars, and small containers with unknown contents unearthed during excavation activities will be first screened by field instruments for radioactivity and then a swipe sample will be collected from the inside of each container and analyzed on site using a gas-flow proportional alpha and beta/gamma radiation counter. A sample of the container content may be collected and sent to the on-site or off-site laboratory by gamma spectroscopy, strontium-90 (^{90}Sr), or alpha spectroscopy, based upon review of the swipe sample results. Once the containers are sampled for radioactivity, the containers will undergo "HazCating" or "waste compatibility screening," which is defined as a series of rapid, qualitative chemical and physical tests conducted to determine potential hazards, handling precautions, storage criteria, and disposal classification of the material in question.

TABLE B.5-1

SAMPLING LOCATIONS/IDS, SAMPLE DEPTHS, SAMPLE ANALYSES, AND SAMPLING PROCEDURES (UFP-QAPP Worksheet #18)

Sampling Location	Matrix	Depth (feet)	Analytical Group	Sampling Section Reference
Reference background areas (As identified in the TSP)	Soil	Surface	As detailed in the TSP	Section 6.3
Final Status Survey, Scoping, Characterization and Remedial Action Support Surveys (As identified in the TSP)	Soil/Debris Water/Swipe	Surface	As detailed in the TSP	Section 6.3
Soil bin waste (radioactive) [a] (WW-PXB-YYYYYYY-UU)	Soil	Random	As appropriate for the ROC	Section 6.3

Notes:

[a] The number of waste samples will be determined in the field based on the amount of waste generated. However, each waste sample will be identified with a unique sequential number and nomenclature identifying the waste with its origin. Waste sampling will be performed as described in Section 6.3.3.

Abbreviations and Acronyms:

ROC – radionuclide of concern
TSP – Task-specific Plan
UFP-QAPP – Uniform Federal Policy for Quality Assurance Project Plans

6.0 SAMPLING PROCEDURES

The following section describes the field instrument calibration and maintenance procedures, inspection of supplies and consumables, and sample collection procedures.

6.1 FIELD INSTRUMENTATION

Field instruments to be used during this project are for radiation detection to conduct radiological surveys. Detailed information including calibration on radiation-detection instruments is discussed in Section 4.8 of the Base-wide Work Plan, Rev. 1, and will not be included in the SAP.

6.2 SUPPLIES AND CONSUMABLES

Supplies and consumables necessary for field activities will be obtained through the appropriate commercial markets and will meet any supply-specific requirements outlined in this section. All supplies and consumables will be inspected by field sampling personnel prior to use. Any supplies and consumables that do not meet requirements will be discarded or returned to the supplier.

Supply-specific requirements include the following:

- Sample bottle containers will meet all guidelines specified in *Specification and Guidance for Obtaining Contaminant-Free Sample Containers*, EPA 540/R-93/051 and OSWER Directive 9240.0-05A (EPA, 1992). If applicable, certifications from the supplier will be retained in the project files.
- Deionized water will be used as the final step for equipment decontamination for non-radiological samples. Certification from the supplier or the on-site laboratory will be retained in the project file.
- The laboratory water used for collecting non-radiological equipment rinsate samples will be certified to be below project QLs. Certification or sampling results from the supplier or the on-site laboratory will be retained in the project files.

Supplies and consumables will be stored in a designated area. The storage area will be protected from adverse conditions (e.g., weather, heat, fuels, etc.) to protect the supplies/consumables from possible outside contamination and breakage.

6.3 SAMPLING PROCEDURES

The following sections provide the sampling procedures and sample-handling protocols to be used for radiological survey actions at HPS. Table B.6-1 lists the sample containers, preservatives, and holding time requirements for each analytical method.

6.3.1 Reference Background Area Samples

Reference background area samples will be collected as follows:

1. Locations will be chosen based on reference background area radiological survey scans.
2. Sampling personnel will don a new pair of disposable nitrile gloves immediately before collecting soil samples at each location.
3. Grab samples will be collected with a disposable plastic scoop into a 250-milliliter (mL) or 500-mL plastic container that will be filled completely.
4. Each container will be labeled.
5. Samples will be sealed and packaged in accordance with Section 6.6 of this SAP.
6. Field documentation including field logbooks and COCs will be filled out during sample collection in accordance with Section 4.0.
7. The samples will then be transferred to the on-site laboratory for analysis.

6.3.2 Media/Swipe Samples

Media/swipe samples for radiological analyses will be collected as follows:

1. Sampling personnel will don a new pair of disposable nitrile gloves immediately before collecting soil samples at each location. The use of a new pair of gloves prior to obtaining swipes of materials that are not assumed to be contaminated is unnecessary.
2. Radiological samples will be collected as specified in the SOP HPO-Tt-009 governing sampling procedures for radiological surveys. This SOP will, at a minimum, establish comparable standards and requirements as the SOP presented in Attachment 2.
3. Sample numbering, labeling, documentation, and packaging procedures will be followed as described in Sections 6.6 to 6.9.
4. Sampling equipment will be screened and decontaminated per Section 6.5 between each sample acquisition.

6.3.3 Waste Characterization Sampling

Bins of radiological impacted waste may be generated during field activities and will require sampling for proper disposal. Where required, samples for radiological analysis will be collected as specified in the SOP HPO-Tt-009 governing sampling procedures for radiological surveys. This SOP will, at a minimum, establish comparable standards and requirements as the SOP presented in Attachment 2. Waste sampling is described in the section below.

6.3.3.1 Bin Sampling Procedures

One sample will be collected from each waste type as it is placed into the bin in accordance with SOP HPO-Tt-009, and will be analyzed by the on-site laboratory by gamma spectroscopy.

6.3.3.2 Water Sampling Procedures

This procedure will be used to collect water samples from approved containers or in-situ water samples from impacted sites.

1. Sampling personnel will don a new pair of disposable nitrile gloves immediately before collecting wastewater samples.
2. Water samples will be collected using a disposable bailer or similar device. Samples will be transferred from the bailers to pre-preserved, pre-cleaned sample containers.
3. Sample numbering, labeling, documentation, and packaging procedures will be followed as described in Sections 6.6 to 6.9.
4. Sampling equipment will be screened and decontaminated per Section 6.5 between each sample acquisition.

6.3.4 Container Content Sampling Procedures

Prior to sampling the contents of the material from each container, a qualitative visual description of the contents of each container will be recorded in the logbook to include the following:

- Any and all exterior markings
- Any unique or unusual container conditions (e.g., reinforced, lined, exotic construction materials, etc.)
- Type of opening(s)
- Approximate amount of material contained in the container
- Physical state, color, clarity, viscosity, number, and relative estimated volume of each identified discrete layer or phase
- Readings from real-time health and safety monitors

Swipe samples of material from the containers will be collected in accordance with SOP HPO-Tt-009, Sampling Procedures for Radiological Surveys (Attachment 2), for sampling of radiological materials.

Liquid samples from containers will be extracted through the bunghole if there is one on the container. If the container contains mostly solid material rather than liquids, the entire top of the container will be removed to sample the contents. Using an appropriate sampling device or a combination of devices, several representative grab samples with a combined volume of up to approximately 250 mL will be withdrawn from each container and carefully placed into a sampling container. If a container contains more than one phase (e.g., solids and liquids or multi-phase liquids), separate samples are to be taken from each phase. If the volume of any individual phase is so small as to preclude recovery of a sufficient sample (any volume less than 200 mL), a remark to this effect will be recorded in the logbook.

Samples will be numbered, labeled, documented, and packaged according to procedures in Sections 6.5 and 6.6.

At the same time the sample is collected for the off-site laboratory analysis, an aliquot will be collected in a labeled test tube and transferred to the HazCat area where the HazCat technician(s) will carry out waste-compatibility screening. The parameters described in Section 5.1 will be tested according to the manufacturer's instructions for the HazCat kit. The results of the HazCat tests will be recorded on a field form and subsequently evaluated to categorize similar types of wastes together for disposal purposes.

6.4 DECONTAMINATION PROCEDURES

Prior to decontamination, sampling equipment will be screened using a hand-held alpha/beta survey meter. If radioactive contamination exceeding the release limit is present, the equipment and local area will be secured and the PRSO will be notified.

After radiological screening, non-disposable sampling equipment will be decontaminated to prevent the introduction of extraneous material into samples and to prevent cross-contamination between samples. All sampling equipment will be decontaminated. Decontamination water will be collected in approved Department of Transportation containers.

The following steps will be applied for the general decontamination of non-disposable sampling equipment, as appropriate:

1. **Wash with nonphosphate detergent and water solution** — This step will reduce the amount of gross contamination from the equipment. Use of a container, approximately 75 percent full of solution, is suggested for this step. This detergent solution will be prepared as directed by the manufacturer.
2. **Rinse with potable water** — This step will rinse all the detergent solution away from equipment. Use of a container, approximately 75 percent full of potable water, is suggested for this step. Periodic changing of this water is required.
3. **Rinse with potable water** — Repeat Step 2. Subsequent to this final rinse, place decontaminated equipment on a clean surface area (plastic sheeting) to air dry.
4. **Radiological screening of equipment** — When dry, survey the post-decontaminated equipment using a hand-held alpha/beta survey meter. If radioactive contamination exceeding the release limits is detected, immediately secure the equipment and local area and notify the PRSO.
5. **Sample investigation-derived waste** — Drummed decontamination fluids will be sampled to characterize the waste for disposal. Drums will be stored in a designated storage area pending receipt of the analytical data. Samples will be collected from each wastewater container.

6.5 SAMPLE NUMBER

Samples will be uniquely designated using a numbering system that identifies the type of sample and a sequential number (i.e., 28-001). Sample numbers will be generated by the TtEC COC Database Program.

The sample number will be recorded in the field logbook, on the labels, and the COC record at the time of sample collection. A complete description of the sample and sampling conditions will be recorded in the field logbook and referenced using the unique sample identification number. The sample number scheme will be as follows:

For radiological samples, the TSP or the PRSO will determine all non-waste bin sample identification schemes. Radiological waste bin sample identification will be as follows:

- Radiological Waste Bin: **WW-PXB-YYYYYYY-UU**, where

  WW – CTO or task order number
  P – Abbreviation for Parcel
  X - Parcel designation (e.g. A for Parcel A, B for Parcel B, etc.)
  B – Indicates a waste bin sample
  YYYYYY – Seven-character waste bin identification number
  UU – Two-character consecutive sample number starting from 001 (number of samples collected from waste bin

6.6 SAMPLE PACKAGING AND SHIPMENT

Sample packaging procedures for radiological samples are as follows.

Sampling packaging and shipping will be performed in accordance with the SOP HPO-Tt-009 governing sampling procedures for radiological surveys. This SOP will, at a minimum, establish standards and requirements comparable to the SOP in Attachment 2.

TABLE B.6-1

ANALYTICAL METHODS, CONTAINERS, PRESERVATIVES, AND HOLDING TIMES REQUIREMENTS (UFP-QAPP Worksheet #19)

Matrix	Analytical Group	Analytical and Preparation Method	Container (number, size, type)	Preservation Requirements (chemical, temperature, etc.)	Maximum Holding Time (preparation/analysis)
Soil/Sediment	Gamma Spectroscopy (on-site laboratory)	C1402-98 Standard Guide for High-Resolution Gamma-ray Spectrometry and/or on-site laboratory SOPs	250-mL or 500-mL plastic container	None	N/A
Soil/Sediment	Gamma Spectroscopy (off-site laboratory)	EPA Method 901.1 (modified for soil) or equivalent	250-mL or 500-mL plastic container	None	6 months
Soil/Sediment	Alpha Spectroscopy (off-site laboratory)	DOE HASL-300 Method or equivalent	250-mL or 500-mL plastic container	None	6 months
Soil/Sediment	Alpha Spectroscopy (on-site laboratory)	NWT's laboratory SOP	250-mL or 500-mL plastic container	None	N/A
Soil/Sediment	Strontium-90 (off-site laboratory)	DOE Method Sr-01/Sr-02 or equivalent	250-mL or 500-mL plastic container	None	6 months
Soil/Sediment	Strontium-90 (on-site laboratory)	NWT's laboratory SOP	250-mL or 500-mL plastic container	None	N/A
Debris	Gamma Spectroscopy (on-site laboratory)	C1402-98 Standard Guide for High-Resolution Gamma-ray Spectrometry and/or on-site laboratory SOPs	250-mL or 500-mL plastic container	None	N/A
Debris	Gamma Spectroscopy (off-site laboratory)	EPA Method 901.1 (modified for soil) or equivalent	250-mL or 500-mL plastic container	None	6 months
Debris	Alpha Spectroscopy (off-site laboratory)	DOE HASL-300 Method or equivalent	250-mL or 500-mL plastic container	None	6 months
Debris	Alpha Spectroscopy (on-site laboratory)	NWT's laboratory SOP	250-mL or 500-mL plastic container	None	N/A
Debris	Strontium-90 (off-site laboratory)	DOE Method Sr-01/Sr-02 or equivalent	250-mL or 500-mL plastic container	None	6 months

TABLE B.6-1

ANALYTICAL METHODS, CONTAINERS, PRESERVATIVES, AND HOLDING TIMES REQUIREMENTS (UFP-QAPP Worksheet #19)

Matrix	Analytical Group	Analytical and Preparation Method	Container (number, size, type)	Preservation Requirements (chemical, temperature, etc.)	Maximum Holding Time (preparation/analysis)
Debris	Strontium-90 (on-site laboratory)	NWT's laboratory SOP	250-mL or 500-mL plastic container	None	N/A
Swipe	Alpha/beta emitting radionuclides (off-site laboratory)	EPA Method 9310 or equivalent	250-mL or 500-mL plastic container	None	6 months
Swipe	Alpha/beta emitting radionuclides (on-site laboratory)	Gross alpha/beta by gas-flow proportional counter or ZnS(Ag) detector; Low-energy beta by liquid scintillation counter and/or on-site laboratory SOP	250-mL or 500-mL plastic container	None	N/A
Water	Gamma Spectroscopy (off-site laboratory)	EPA Method 903 or equivalent	Two 1-L Poly bottles	pH ≤ 2 w/HNO_3	6 months
Water	Gamma Spectroscopy (on-site laboratory)	NWT's laboratory SOP	250-mL or 500-mL plastic container	None	N/A
Water	Strontium-90 (on-site laboratory)	NWT's laboratory SOP	100-mL or 250-mL plastic container	pH ≤ 2 w/HNO_3	6 months
Water	Alpha Spectroscopy (on-site laboratory)	NWT's laboratory SOP	100-mL or 250-mL plastic container	pH ≤ 2 w/HNO_3	6 months
Water	Strontium-90 (off-site laboratory)	EPA Method 905.0 or equivalent	Two 1-L Poly bottles	pH ≤ 2 w/HNO_3	6 months
Water	Alpha Spectroscopy	DOE HASL-300 Method or equivalent	Two 1-L Poly bottles	pH ≤ 2 w/HNO_3	6 months

TABLE B.6-1

ANALYTICAL METHODS, CONTAINERS, PRESERVATIVES, AND HOLDING TIMES REQUIREMENTS (UFP-QAPP Worksheet #19)

Abbreviations and Acronyms:

DOE – Department of Energy
EPA – U.S. Environmental Protection Agency
g – gram
HASL – Health and Safety Laboratory
HNO_3 – nitric acid
L – liter
mL – milliliter
mm – millimeter
N/A – not applicable
NWT – New World Technologies, Inc.
SOP – Standard Operating Procedure
UFP-QAPP – Uniform Federal Policy for Quality Assurance Project Plans

7.0 ANALYTICAL DATA QUALITY OBJECTIVES

This section identifies the laboratory quality objectives, data quality indicators, and field quality objectives.

7.1 OFF-SITE LABORATORY QUALITY OBJECTIVES

The following sections describe analytical laboratory requirements, including qualifications, sample custody, and QC procedures.

7.1.1 Off-Site Laboratory Qualifications

The analytical laboratories selected to analyze samples for this project will be, at a minimum, certified by the California Department of Health Services (DHS) for all of the analytical methods required for the project. Additional state certifications may also be required for off-site radiological testing as required by the disposal facility. In addition, the laboratory must successfully complete the Naval Facilities Engineering Service Center (NFESC) Laboratory Evaluation Program prior to sampling activities and maintain current status throughout the duration of the project.

The laboratory selected for the project must be capable of providing the project QC and data deliverables required by this SAP.

Laboratories, once selected, must be capable of meeting all the requirements listed in this SAP including turnaround time (to be determined), QLs, QC criteria, data deliverables, and requirements in the *Navy Installation Restoration Chemical Data Quality Manual* (IRCDQM) (NFESC, 1999), and the *Quality Systems Manual (QSM) for Environmental Laboratories* (DoD, 2006).

7.1.2 Off-Site Laboratory Sample Custody and Documentation

The integrity and traceability of samples from the time they are collected through the time data are reported are essential in any sampling and analysis program. The handling of the samples and transferring of custody must be well-documented given the evidentiary nature of the analytical data. A sample is considered to be in one's custody if it meets any of the following criteria:

1. In actual possession or in view of the person who collected the sample
2. Locked in a secure area
3. Placed in an area restricted to authorized personnel

The samples will be delivered to the person in the laboratory authorized to receive samples (referred to as the sample custodian). Upon receipt of a sample, the sample custodian will inspect the condition of the sample (including the temperature of the cooler as applicable) and the custody seal, reconcile the information on the sample label against that on the COC record, assign a unique laboratory tracking number, log the sample in the laboratory logbook, and store the sample in a secured sample storage room.

The TtEC Project Chemist will be informed immediately of any inconsistencies between the COC record and the sample containers received. Any deviations from accepted sample handling procedures will be documented, and the TtEC Project Chemist will be informed.

The laboratory will have a system for tracking samples consistent with Section 5.8 of the QSM (DoD, 2006). The laboratory will archive the samples and maintain their custody up to 90 calendar days after sample collection, at which time the laboratory will contact TtEC for disposition.

7.1.3 Off-Site Laboratory Quality Control Requirements

The analytical laboratory will have written SOPs defining the instrument operation and maintenance, tuning, calibration, method detection limit (MDL) determination, QC acceptance criteria, blank requirements, and stepwise procedures for each analytical method. At a minimum, SOPs will be written for procedures and methods including sample receipt/control/disposal, sample preparation/extraction, sample analysis, result calculation, database management, health and safety, and corrective action. The SOPs, and all revisions, will be available to the analysts in the laboratory. The SOPs must meet the requirements of the analytical methods, the *IRCDQM* (NFESC, 1999), and the QSM (DoD, 2006).

The laboratory must also maintain written records of all activities that have an impact on the quality of the laboratory results.

Any portion of the method subcontracted by the laboratory to another laboratory or sent to another facility of the same network of laboratories must have the prior approval of the Project Chemist or RSO.

7.1.4 Off-Site Laboratory Quality Control Checks

The following subsections describe in detail the laboratory QC checks required by this project.

7.1.4.1 Calibration

All instruments will be calibrated and the calibration acceptance criteria met before samples are analyzed. Calibration standards will be prepared with National Institute for Standards and Testing-traceable standards and analyzed per method requirements. ICAL acceptance criteria

documented in the laboratory SOPs will meet those of applicable guidance documents. The ICAL will meet the following requirements:

- The lowest concentration of the calibration standard is less than or equal to the QLs based on the final volume of extract or sample.
- For each target analyte, at least one of the calibration standards will be at or below the regulatory limit (action level), as defined by the DQOs.
- Before samples are analyzed, ICAL will be verified with a second source standard prepared at the mid-point of the calibration curve. ICAL verification will meet the acceptance criteria expressed in the laboratory SOPs.
- Daily calibration verification will be conducted at the method-prescribed frequencies and will meet the acceptance criteria of applicable guidance documents. Daily calibration verification will not be used for quantitation of target analytes.
- Calibration data (calibration tables, chromatograms, instrument printouts, and laboratory logbooks) will be clearly labeled to identify the source and preparation of the calibration standard and therefore be traceable to the standard preparation records.

7.1.4.2 Instrument Blanks

An instrument blank is used to monitor the cleanliness of the instrument system during sample analysis. Instrument blanks or backgrounds will be performed as designated in the appropriate SOP.

7.1.4.3 Method Blanks

Method blanks are prepared in the same manner as the samples, using the same reagents and glassware used for samples. The purpose of the method blank is to ensure that the equipment and reagents used in preparing the samples are free of contaminants that could interfere with the analysis. The method blank must be prepared and analyzed for each batch of 20 project samples or less per matrix (aqueous and solid) type.

The method blank must not exhibit analytes at concentrations greater than half the required QLs. If contaminants are found that either contribute to the apparent concentration of a particular target analyte or interfere with the analysis, the analysis must be stopped, the source of contamination identified and corrected, and the analysis repeated. Contamination in the method blank above half the QLs will require that the entire associated batch of extracts or digestates be reprepared and reanalyzed. Hence, it is very important to make sure that no such contamination is present.

Some methods of inorganic analysis do not have a distinctive preparation step. For these tests, an instrument blank, which contains all reagents used with samples, is considered to be the method blank.

7.1.4.4 Off-Site Laboratory Control Samples

Laboratory control samples are matrix-equivalent QC check samples (analyte-free water, laboratory sand, or sodium sulfate) spiked with a known quantity of specific analytes carried through the entire sample preparation and analysis process. The spiking solution used for LCS/LCSD preparation is of a source different from the stock used to prepare calibration standards.

The LCS is prepared and run at a frequency of one per 20 project samples per matrix with the associated samples, using the same reagents and volumes. If insufficient quantity of sample is available for the MS/MSD, the LCS will be prepared and analyzed in duplicates.

7.1.4.5 Off-Site Laboratory Duplicates

For laboratory sample duplicate analyses, a sample is prepared and analyzed twice. Laboratory sample duplicates are prepared and analyzed with each batch of samples for most inorganic analyses. For this project, a laboratory duplicate will be prepared and analyzed for the on-site and off-site laboratory for each batch of samples. A batch is defined as 20 samples or less.

7.1.4.6 Off-Site Matrix Spikes

MSs are QC check samples that measure matrix-specific method performance for chemical analysis not to include radiological analysis.

7.1.4.7 Preventative Maintenance

All instruments must be maintained in accordance with the manufacturers' recommended procedures. The laboratory must define in its QA plan the frequency and type of maintenance for each instrument. The laboratory must also record all maintenance activities in an instrument logbook. The laboratory must maintain the instruments in working condition required by the methods specified for the analyses. Sufficient redundancy in equipment must be available in the laboratory to handle downtime situations. Method substitution because of instrumental failure will not be permitted without approval from the Project Chemist or PRSO.

In addition to preventive maintenance, the laboratory must keep a sufficient supply of replacement parts on hand for those parts known to require frequent changes due to wear and tear or contamination. Whenever preventive or corrective maintenance is applied to an instrument, the laboratory must demonstrate the instrument's return to operating conditions and must recalibrate the instrument prior to resumption of sample analyses.

7.2 ON-SITE LABORATORY QUALITY OBJECTIVES

NWT will perform gamma and alpha spectroscopy, ^{90}Sr analysis, gross alpha/beta, and low energy beta analyses using NWT's SOPs approved by the RASO. California DHS certification and NFESC evaluation are not required for the on-site radiological laboratory per written

confirmation from DHS and EPA. Prior to analyzing project samples for ^{90}Sr and alpha spectroscopy, NWT will perform method validation as described in Section 7.2.3.

7.2.1 On-Site Laboratory Sample Custody and Documentation

The integrity and traceability of samples from the time they are collected through the time data are reported are essential in any sampling and analysis program. The handling of the samples and transferring of custody must be well-documented given the evidentiary nature of the analytical data. A sample is considered to be in one's custody if it meets any of the following criteria:

1. In actual possession or in view of the person who collected the sample
2. Locked in a secure area
3. Placed in an area restricted to authorized personnel

The samples will be delivered to the person in the laboratory authorized to receive samples. Upon receipt of a sample, the sample condition is inspected, and verification of the information on the sample container is checked against that on the COC record. The sample is logged in the laboratory logbook. The sample will be stored in a secured room.

7.2.2 On-Site Laboratory Quality Control Requirements

The analytical laboratory must have written SOPs defining the instrumentation, calibration, method detection, and QC requirements. The SOPs must be available to the analysts performing the work. The SOPs must meet or exceed the requirements of the analytical methods cited in this SAP. The laboratory must maintain logs of all activities that have an impact on the quality of the laboratory results.

The laboratory must maintain the instruments in working condition required by the methods specified for the analyses. Sufficient redundancy in equipment must be available in the laboratory to handle downtime situations.

7.2.3 Method Validation

Samples analyzed for ^{90}Sr and alpha spectroscopy will be performed by the NWT laboratory in accordance with approved SOPs (Attachment 2). The SOPs must be reviewed and approved by the RASO prior to analyzing field samples.

After method performance characteristics are determined, 12 samples will be analyzed by the NWT laboratory and the off-site laboratory for method validation. The 12 samples will be prepared from each of the three previously analyzed samples for ^{90}Sr and alpha spectroscopy. One sample with reported concentration below the RRO and two samples with concentration above the RRO will be selected.

The 12 samples will be prepared by splitting each of the three samples in half and then splitting each half into four equal halves. One set of four equal halves from each of the three samples will be given to the on-site laboratory to analyze and the other set will be given to the off-site laboratory to analyze. Results will be reviewed by TtEC and the RASO in order to determine if the on-site laboratory method has been validated adequately such that the on-site laboratory can continue to analyze all field samples by those methods.

7.2.4 On-Site Laboratory Quality Control Checks

The following subsections describe in detail the laboratory QC samples required for the on-site laboratory. Use of laboratory control standards will be documented, if necessary, in the applicable SOP that governs the procedure in use. All certifications from the laboratory control standard use at the on-site laboratory will be submitted to the PRSO for the project file.

7.2.4.1 Laboratory Duplicates

Laboratory sample duplicates are prepared and analyzed with each batch of systematic samples for most inorganic analyses. Laboratory duplicate samples will be analyzed independently as appropriate. For this project, a laboratory duplicate will be prepared and analyzed by gamma spectroscopy for the on-site laboratory for each survey unit's systematic samples. A laboratory duplicate will be prepared and analyzed for the on-site laboratory for each batch of alpha spectroscopy and strontium samples. A batch is defined as 20 samples or less. If the sample analysis identifies no activity greater than the MDA to be present, the total activity of the sample will be used for comparison.

7.2.4.2 Calibration

All instruments and equipment must be calibrated in accordance with the manufacturer's requirements and/or laboratory SOPs. Each instrument must be calibrated with the standard appropriate to the type of instrument and the calibration range established for the method.

ICALs are performed when the method is first used and again whenever the continuing calibrations fail to meet their respective acceptance criteria. In addition, if the instrument undergoes significant maintenance, the ICAL must be repeated. Calibration of all equipment will be performed in accordance with the on-site laboratory's SOPs.

Continuing calibrations verify that the instrument performance has remained within the limits set at the time of the ICAL. The frequency of continuing calibrations is specified in referenced methods.

7.2.4.3 Instrument Blanks

Instrument backgrounds are run to ensure that contaminants from previous runs are out of the system and do not contaminate succeeding runs. Instrument backgrounds are performed before sample analyses are performed and after samples containing high concentrations of potentially interfering materials are found, in accordance with the NWT SOP.

7.2.4.4 Method Blanks

Method backgrounds are performed on a daily basis in the same manner as the samples, using the same container geometry used for samples. The purpose of the method backgrounds is to ensure that the equipment is free of contaminants that could interfere with the analysis.

7.2.4.5 Preventative Maintenance

All instruments must be maintained in accordance with the manufacturers' recommended procedures. The laboratory must define in its QA plan the frequency and type of maintenance for each instrument. The laboratory must also record all maintenance activities in an instrument logbook. The laboratory must maintain the instruments in working condition required by the methods specified for the analyses. Sufficient redundancy in equipment must be available in the laboratory to handle downtime situations. Method substitution because of instrumental failure will not be permitted without approval from the Project Chemist or PRSO.

In addition to preventive maintenance, the laboratory must keep a sufficient supply of replacement parts on hand for those parts known to require frequent changes due to wear and tear or contamination. Whenever preventive or corrective maintenance is applied to an instrument, the laboratory must demonstrate the instrument's return to operating conditions and must recalibrate the instrument prior to resumption of sample analyses.

7.3 DATA QUALITY INDICATORS

In order to meet project DQOs, the QLs listed in Tables B.7-1 (soil) and B.7-2 (water) were established below action levels, and the QC criteria presented in Table B.7-3 are in accordance with the QSM (DoD, 2006).

Analytical DQOs will be assessed through application of precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters discussed in this section.

7.3.1 Precision

Precision is the measure of the reproducibility of a set of replicate results or the agreement among repeat observations made under the same conditions. Analytical precision is the measurement of the variability associated with duplicate or replicate analyses. Field duplicate, laboratory duplicate, MSD, and LCSD (if analyzed) samples will be used to assess field and analytical precision. The precision measurement will be determined using the RPD between the duplicate sample results as follows:

$$RPD = 100 \times 2 \times (\text{result} - \text{duplicate result})/(\text{result} + \text{duplicate result})$$

The RPD limits for laboratory duplicate, MSD, and LCSD are presented in Table B.7-3. Associated samples that do not meet the criteria will be evaluated by the validator as described in Section 8.2.

7.3.2 Accuracy

Accuracy is defined as the nearness of a result or the mean of a set of results to the true or accepted value. Analytical accuracy is measured by comparing the percent recovery (%R) of analytes spiked into a sample against a control limit. Spiked samples include MS, MSD, and LCS analyzed for every batch of up to 20 samples. They serve as a measure of analytical accuracy and surrogate standards added to all samples, blanks, MS, MSD, and LCS analyzed for organic contaminants to evaluate the method's accuracy and help to determine matrix interferences. %R is calculated as follows:

%R = 100 x (spiked sample result - unspiked sample result)/amount of spike added

The laboratory will review the QC samples and surrogate standard recoveries for each analysis to ensure that the %R lies within the control limits listed in Table B.7-3. Otherwise, data will be flagged as discussed in Section 8.2.

7.3.3 Representativeness

Unlike precision and accuracy, which can be expressed in quantitative terms, representativeness is a qualitative parameter. Representativeness is the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. It is a qualitative parameter that depends on proper design of the sampling program.

Field personnel will be responsible for ensuring that samples are representative of field conditions by collecting and handling samples according to the procedures in this SAP. Errors in sample collection, packaging, preservation, or COC procedures may result in samples being judged non-representative and may form a basis for rejecting the data.

7.3.4 Completeness

Completeness is the percentage of measurements made that is judged to be valid. The completeness goal is to generate a sufficient amount of valid data to meet project needs. Completeness is calculated and reported for each method, matrix, and analyte combination. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of the data set. For completeness requirements, valid results are all results not qualified with a rejected (R) flag. The requirement of completeness for analyses is 95 percent for samples and is determined using the following equation:

% completeness = 100 x (number of valid analyte results/number of possible results)

7.3.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another, whether it was generated by a single laboratory or during interlaboratory studies. The use of standardized field and analytical procedures ensures comparability of analytical data.

Sample collection and handling procedures will adhere to EPA-approved protocols. Laboratory procedures will follow standard analytical protocols, use standard units, use standardized report formats, follow the calculations as referenced in approved analytical methods, and use a standard statistical approach for QC measurements.

7.4 FIELD QUALITY CONTROL SAMPLES

Field QC samples include field duplicates for water samples, equipment rinsates and source blanks for decontamination of disposable sampling equipment, trip blanks for chemical volatile organic analysis, and temperature blanks for samples required to be stored on ice. For radiological analyses, field duplicates are not applicable since water samples collected for this project are for waste characterization purposes only; equipment rinsate and source blanks are not applicable since only disposable sampling equipment will be used for this project; trip blanks are not applicable since chemical volatile organic analysis is not required for this project; and temperature blanks are not applicable since radiological samples are not required to be stored on ice.

TABLE B.7-1

REFERENCE LIMITS FOR SOLID SAMPLES
(UFP-QAPP Worksheet #15)

Analytical Group/Method	Analyte	CAS Number	Project Action Limit for Solid Samples (residential reuse) [a]	Project Action Limit for Solid Samples (industrial reuse) [a]	Project QLs/MDAs	Analytical Method MDLs [b]	Analytical Method QLs/MDAs [b]	Units
Gamma-emitting isotopes/901.1 modified for soil (off-site laboratory) and/or NWT SOPs (on-site laboratory	Americium-241	86954-36-1	1.36	5.67	0.5	N/A	0.5	pCi/g
	Cobalt-60	10198-40-0	0.0361	0.0602	0.018	N/A	0.018	pCi/g
	Europium-152	14683-23-9	0.13	0.13	0.065	N/A	0.065	pCi/g
	Europium-154	15585-10-1	0.23	0.23	0.12	N/A	0.12	pCi/g
	Uranium-235	15117-96-1	0.195	0.398	0.098	N/A	0.098	pCi/g
	Radium-226	13982-63-3	1.0 above background	1.0 above background	0.5	N/A	0.5	pCi/g
	Cesium-137	10045-97-3	0.113	0.113	0.05	N/A	0.05	pCi/g
DOE Method Sr-01/Sr-02 or equivalent (off-site laboratory) or NWT SOPs (on-site laboratory)	Strontium-90	10098-97-2	0.331	10.8	0.166	N/A	0.166	pCi/g
Alpha-emitting isotopes/DOE HASL-300 Method or equivalent (off-site laboratory) and/or NWT SOPs (on-site laboratory)	Alpha-emitting radionuclides	TBD [c]	TBD	TBD	TBD	TBD	TBD	pCi/g

Notes:

[a] Levels listed are based on radiological remedial objectives in Table B.1-1.

[b] Values listed are from validated methods.

[c] Table will be updated prior to each investigation based on the site-specific information presented in each TSP*Abbreviations and Acronyms:*

CAS – Chemical Abstract Service
DOE – Department of Energy
HASL – Health and Safety Laboratory
MDA – minimum detectable activity
MDL – method detection limit
N/A – not applicable
NWT – New World Technologies, Inc.
pCi/g – picocurie per gram
QL – quantitation limit
SOP – Standard Operating Procedure
TBD – to be determined
UFP-QAPP – Uniform Federal Policy for Quality Assurance Project Plans

TABLE B.7-2

REFERENCE LIMITS FOR WATER SAMPLES
(UFP-QAPP Worksheet #15)

Analytical Group/Method	Analyte	CAS Number	Discharge Limits for Wastewater Samples	Regulatory Limit for Wastewater Samples (STLC)	Regulatory Limit for Wastewater Samples (TCLP)	Project QLs/MDAs	Analytical Method MDLs [a]	Analytical Method QLs/MDAs [a]	Units
Gamma-emitting isotopes/ EPA Method 903 (off-site laboratory) and/or NWT SOPs (on-site laboratory	Americium-241	86954-36-1	15	NE	NE	7.5	N/A	7.5	pCi/L
	Cobalt-60	10198-40-0	100	NE	NE	50	N/A	50	pCi/L
	Europium-152	14683-23-9	60	NE	NE	30	N/A	30	pCi/L
	Europium-154	15585-10-1	200	NE	NE	100	N/A	100	pCi/L
	Uranium-235	15117-96-1	30	NE	NE	15	N/A	15	pCi/L
	Radium-226	13982-63-3	5	NE	NE	2.5	N/A	2.5	pCi/L
	Cesium-137	10045-97-3	119	NE	NE	60	N/A	60	pCi/L
DOE Method Sr-01/Sr-02 or equivalent (off-site laboratory) or NWT SOPs (on-site laboratory)	Strontium-90	10098-97-2	8	NE	NE	4	N/A	4	pCi/L
Alpha-emitting isotopes/DOE HASL-300 Method or equivalent (off-site laboratory) and/or NWT SOPs (on-site laboratory)	Alpha-emitting radionuclides	TBD [b]	TBD	TBD	TBD	TBD	TBD	TBD	pCi/L

Notes:

[a] Values listed are from validated analytical methods.

[b] Table will be updated prior to each investigation based on the site-specific information presented in each TSP

Abbreviations and Acronyms:

EPA – U.S. Environmental Protection Agency
DOE – Department of Energy
HASL – Health and Safety Laboratory
MDA – minimum detectable activity
MDL – method detection limit
N/A – not applicable
NE – none established
NWT – New World Technologies, Inc.
pCi/L – picocurie per liter
QL – quantitation limit
SOP – Standard Operating Procedure
STLC – Soluble Threshold Limit Concentration
TBD – to be determined
TCLP – Toxicity Characteristic Leaching Procedure

TABLE B.7-3

QUALITY CONTROL ACCEPTANCE CRITERIA

Method	Analyte	CAS Number	Accuracy Soil (%R) [a]	Precision Soil (RPD) [b]	Accuracy Water (%R) [a]	Precision Water (RPD) [b]
EPA Method 901.1 modified for soil/903 (water) or equivalent (off-site laboratory) and/or NWT SOPs (on-site laboratory)	Americium-241	86954-36-1	N/A	≤ 30	N/A	≤ 30
	Cobalt-60	10198-40-0	N/A	≤ 30	N/A	≤ 30
	Europium-152	14683-23-9	N/A	≤ 30	N/A	≤ 30
	Europium-154	15585-10-1	N/A	≤ 30	N/A	≤ 30
	Uranium-235	15117-96-1	N/A	≤ 30	N/A	≤ 30
	Radium-226	13982-63-3	N/A	≤ 30	N/A	≤ 30
	Cesium-137	10045-97-3	N/A	≤ 30	N/A	≤ 30
	Total Activity [c]	N/A	N/A	≤ 30	N/A	≤ 30
DOE Method Sr-01/Sr-02 or equivalent for soil/EPA Method 905.0 or equivalent for water (off-site laboratory) and/or NWT SOPs (on-site laboratory)	Strontium-90	10098-97-2	75-115	≤ 30	75-115	≤ 30
DOE HASL-300 Method or equivalent (off-site laboratory) and/or NWT SOPs (on-site laboratory)	Alpha-emitting radionuclides	TBD [d]	TBD	TBD	TBD	TBD

Notes:

[a] %R limits listed are for LCS/LCSD.

[b] RPD limits listed are for LCS/LCSD and laboratory duplicate.

[c] If no activity is present greater than the minimum detectable activity, RPD for laboratory duplicate will be for the total activity present, for radionuclides with reported activity.

[d] Table will be updated prior to each investigation based on the site-specific information presented in each TSP

Abbreviations and Acronyms:

%R – percent recovery
DOE – Department of Energy
EPA –U.S. Environmental Protection Agency
CAS – Chemical Abstract Service
HASL – Health and Safety Laboratory
LCS – laboratory control sample
N/A – not applicable
NWT – New World Technologies, Inc.
RPD – relative percent difference
SOP – Standard Operating Procedure
TBD – to be determined
LCSD – laboratory control sample duplicate

8.0 DATA MANAGEMENT

It is important that complete and relevant data and documentation are properly maintained and provided to the appropriate agencies. The methods for maintaining, tracking, and managing project documentation and records (hard-copy and electronic media) to provide a complete, defensible record of the radiological condition of each site are described in this section. The DON will receive summaries of data as collected, plus draft and final data reports. The data management system will ensure that sufficient data and information are properly maintained and available to ensure an independent evaluation of the results of the survey, including repeating measurements at some future date.

This section discusses the data-management procedures for samples collected for this project, tracing the path of the field and laboratory data from generation, review, and verification to storage and final use. The quality of the data collection process will be assessed through reviews of all documentation and measurements performed and verification that information recorded is accurate and complete. Project documentation that will be generated is presented in Table B.4-1.

8.1 DATA GENERATION

Two types of data will be generated: field data and laboratory data. These types are described in the following sections.

8.1.1 Field Data

Field sampling data, including field logbooks and field forms, will be maintained. The logbooks will be numbered sequentially on the cover by the PQCM and that number will be entered into a log sheet maintained by the PQCM for the project. Field logbooks and forms will be reviewed by the PQCM and verified as described in Table B.8-1. A copy of all field forms containing information pertaining to sample collection (such as calibration forms) will be forwarded to the Project Chemist.

A copy of the COCs for the off-site laboratory samples will be faxed/e-mailed to the Project Chemist on a daily basis for review and communication with the laboratory. A copy of the COCs for the on-site laboratory samples will be given to the PRSO. The COCs will be reviewed by the Project Chemist, RTM, and PRSO for completeness daily. The manila copy of the COC form will be transferred to the Project Chemist or PRSO. The Project Chemist and PRSO will maintain field documents and forward them to the main project file in San Diego, California, at the completion of the project.

8.1.2 Laboratory Data

The off-site and on-site laboratory will report data to TtEC by submitting hard-copy data as described in Section 4.2.

For the off-site laboratory analysis, 90 percent of the data will be submitted in an EPA Level III-equivalent data package and 10 percent submitted in an EPA Level IV-equivalent data package as described in Section 4.2. All data reported by the off-site laboratory will be verified as described in Table B.8-1 and validated as described in Table B.8-2.

As described in Section 7.1.2, the off-site laboratory will verify sample receipt and document it in a sample receipt form. In addition, samples will be assigned a unique number and recorded in the off-site laboratory internal COC.

All data reported by the analyst must be reviewed by a peer analyst qualified to perform the method and a supervisor prior to reporting the data to TtEC. In addition, the off-site laboratory QA manager must review 10 percent of the data reported for each section, annually. The off-site laboratory QA manager review may be conducted after the data have been reported to TtEC.

All data will be reported to TtEC on or before the designated turnaround time by fax/email. The Project Chemist will review the data upon receipt prior to releasing to project personnel to verify that the sampling procedures and analytical results were obtained following the protocols in this SAP and are of sufficient quality to satisfy DQOs.

On or before 21 days from sample receipt, the off-site laboratory will submit hard-copy data with associated QC information, as described in Section 4.2, along with an electronic format of the data to TtEC as described in Section 8.1.3.

Hard-copy data will be submitted to the DON administrative record concurrently with reports submitted to the DON discussing that applicable data set.

8.1.3 Electronic

Field data from the COCs (date and time collected, sample identification, etc.) will be entered into the TtEC database by the Project Chemist. Survey data will be recorded by a field surveyor and also entered into the database. All sample locations will be surveyed in accordance with *Environmental Work Instruction (EWI) EVR.6, Environmental Data Management and Required Electronic Delivery Standards* (Naval Facilities Engineering Command - Southwest [NFECSW], 2005). Horizontal control information will be captured in the State Plane Coordinate System (North American Datum 83) in feet, and vertical control standards will be in mean sea level (North American Vertical Datum 88) in feet. All manual entries into the database will be 100 percent verified by the Project Chemist by checking the manual entry against the hard-copy information.

The EDD from the off-site laboratory, which will be compatible with NEDD requirements, will be uploaded into the TtEC database. The data will be checked for required values and project-specific requirements by the database. Any discrepancies in the EDD will either be corrected by TtEC, or the off-site laboratory will be notified to make corrections. Ten percent of the data will be checked by the Project Chemist against the hard-copy data package. If errors are found in the electronic data, the Project Chemist will contact the off-site laboratory for correction.

The Data Manager will conduct weekly backup of the database and maintain the backup file for three months.

Data will be reported in tabular format to be included in the report. The electronic data in NEDD format will be submitted within 30 calendar days after validation is received to the DON as described in *EWI EVR.6, Environmental Data Management and Required Electronic Delivery Standards* (NFECSW, 2005). An e-mail confirmation received by TtEC for all NEDD project submittals will be forwarded to the project file.

8.2 DATA VALIDATION

All sample results with the exception of waste characterization samples and on-site laboratory radiological results will be validated by an independent data validation company. Data will be validated at 80 percent EPA Level III and 20 percent EPA Level IV. The validation will be in accordance with *Environmental Work Instruction (EWI) #1, 3EN2.1, Chemical Data Validation* (Southwest Division, Naval Facilities Engineering Command [SWDIV], 2001) and the QC criteria specified in the referenced methods and in this SAP. Currently, there are no standards for data validation of radiological analyses. Therefore, guidance documents on validation of radiological data and modified functional guidelines will be used by the validator. Data not meeting method and/or SAP specifications will be flagged as estimated ("J") or rejected ("R").

The data validation company will have the following qualifications:

1. A minimum of 5 years of experience in the environmental data validation business
2. Prior experience on DON RAC or Comprehensive Long-term Environmental Action projects
3. DON data validation experience
4. Active peer review program

Personnel must have the following qualifications:

1. Data Reviewer:
    a. Bachelor of Science degree or higher in chemistry or a physical science
    b. Five years of combined experience with approximately 2 years in data validation and 3 years conducting laboratory analysis in an environmental laboratory using the EPA-approved methods being validated

2. Peer Reviewer:
    a. Bachelor of Science degree or higher in chemistry or a physical science
    b. Five years of combined experience with approximately 2 years in data validation and 3 years conducting laboratory analysis in an environmental laboratory using the EPA-approved methods being validated

Data validation reports will be submitted to TtEC as described in Section 4.3. The validator reports will be filed with the respective analytical data package.

8.3 DATA QUALITY ASSESSMENT

After data are validated, the Project Chemist will review and assess field and laboratory quality control. The PARCC parameters will be determined as described in Section 7.2. The Project Chemist will review the data validation reports for any deviations and qualify data. The following data qualifiers will be used (except for the on-site laboratory gamma spectroscopy analysis, which may use more specific qualifiers that will be listed on reports):

J – Result is estimated
U – Analyte is not detected at or above the stated QL
R – Data are rejected
UJ– Analyte is not detected, but there is an uncertainty about the QL

Data qualifiers are used to indicate uncertainties associated with the data. The assigned qualifiers will be entered into the validation code field in the database. In addition, data will be assessed through the evaluation of the PARCC parameters.

The Project Chemist will prepare a data quality assessment report that will summarize the findings of the data assessment and discuss usability of the data to be included in the report.

TABLE B.8-1

VERIFICATION PROCESS

(UFP-QAPP Worksheet #34)

Verification Input	Description	Internal/ External	Responsible for Verification (Name, Organization)
Field logbook	Field logbooks will be reviewed weekly and verified that the information is complete in accordance with requirements in Section 4.1.1. The inspection will be documented in daily QC reports.	I	PQCM, TtEC
COC forms	COC forms will be reviewed daily upon their completion and verified for completeness.	I I I	PQCM, TtEC Project Chemist, TtEC PRSO, RSRS Radiation Task Manager, NWT
Sample receipt	For off-site laboratory samples shipped via courier or FedEx®, the Project Chemist will verify receipt of samples by the laboratory the day following shipment.	I	Project Chemist, TtEC
Sample logins	Sample login information will be reviewed and verified for completeness in accordance with the COC forms.	I E	Project Chemist, TtEC Laboratory Manager, NWT
Laboratory data prior to release	Laboratory data will be reviewed and verified for completeness against analyses requested on the COC forms.	E	Laboratory Manager, NWT
Laboratory data due at turnaround time listed on COC	Laboratory data will be verified that the analyses reported are consistent with the analyses requested on the COC forms.	I I	Project Chemist, TtEC PRSO, RSRS
Laboratory data packages	All laboratory data packages will be verified for completeness by the laboratory performing the work. Data packages will then be reviewed by the Project Chemist or PRSO for completeness in accordance with the data package requirements described in Section 4.5.	E I I	Laboratory, NWT Laboratory, Eberline Project Chemist, TtEC PRSO, RSRS
Field and electronic data	One hundred percent of manual entries will be reviewed against the hard-copy information and 10 percent of electronic uploads will be checked against the hard copy.	I I	Project Chemist, TtEC PRSO, RSRS

Abbreviations and Acronyms:

COC – chain of custody
PQCM – Project Quality Control Manager
QC – quality control
NWT – New World Technologies, Inc.
PRSO – Project Radiation Safety Officer
RSRS – Radiological Survey & Remedial Services, LLC
TBD – to be determined
TtEC – Tetra Tech EC, Inc.
UFP-QAPP – Uniform Federal Policy for Quality Assurance Project Plans

TABLE B.8-2

VALIDATION STEPS (IIA AND IIB) PROCESS

(UFP-QAPP Worksheet #35)

Step IIa/IIb	Validation Input	Description	Responsible for Validation (Name, Organization)
IIa	Field logbook	Field logbooks will be reviewed weekly for accuracy associated with each sampling event. The inspection will be documented in daily QC reports.	PQCM, TtEC
IIa	COC forms	COC forms will be reviewed daily to ensure that project information, sample analyses requested, number of field QC samples collected, and percent level III or IV validation chosen is accurate and in accordance with the requirements in this SAP.	PQCM, TtEC Project Chemist, TtEC PRSO, RSRS
IIa	Sample receipt	The sample cooler will be checked for compliance with temperature (for chemical samples) and packaging requirements listed in Section 6.5 of this SAP.	Laboratory sample custodian, Eberline
IIa	Sample logins	Sample login will be reviewed for accuracy against the COC form.	Project Chemist, TtEC Laboratory Project Manager, Eberline
IIa	Laboratory data prior to release	Laboratory data will be reviewed to ensure that the data is accurate and meets the requirements in this SAP. Prior to release, data will be validated to ensure that.	Laboratory Project Manager, Eberline
		100 percent of the data comply with the method- and project-specific requirements and that any deviations or failure to meet criteria are documented for the project file.	Laboratory Analyst, Eberline
		100 percent of manual entries are free of transcription errors and manual calculations are accurate; computer calculations are spot-checked to verify program validity; data reported are compliant with method- and project-specific QC requirements; raw data and supporting materials are complete; spectral assignments are confirmed; descriptions of deviations from method or project requirements are documented; significant figures and rounding have been appropriately used; reported values include dilution factors; and results are reasonable.	Laboratory Peer Analyst, Eberline
		Data reported are compliant with method- and project-specific QC requirements; the reported information is complete; the information in the report narrative is complete and accurate; and results are reasonable.	Laboratory Supervisor, Eberline
		Data reported are compliant with method- and project-specific QC; analytical methods are performed in compliance with approved SOPs. This review may be conducted after release of data since they are done only on 10 percent of the data.	Laboratory Quality Assurance Manager, Eberline

TABLE B.8-2

VALIDATION STEPS (IIA AND IIB) PROCESS

(UFP-QAPP Worksheet #35)

Step IIa/IIb	Validation Input	Description	Responsible for Validation (Name, Organization)
IIa	Laboratory data due at turnaround time listed on COC	Laboratory data will be reviewed to ensure that the data reported met the analyte list and limits listed in Tables B.7-1 and B.7-2.	Project Chemist, TtEC PRSO, RSRS
IIa	Laboratory data packages	All laboratory data packages will be validated by the laboratory performing the work for technical accuracy prior to submittal.	Laboratory Project Manager, Eberline
		Data packages will then be reviewed for accuracy against the laboratory data that was faxed/e-mailed at the turnaround time listed on the COC.	Project Chemist, TtEC PRSO, RSRS
		Data packages will be evaluated externally by undergoing data validation as described in Section 8.2.	Third-party data validator, TBD
IIb	Data validation reports	Data validation reports will be reviewed in conjunction with the project DQOs and data quality indicators (listed in Section 7.2).	Project Chemist, TtEC

Abbreviations and Acronyms:

COC – chain of custody
DQO – data quality objective
PQCM – Project Quality Control Manager
QC – quality control
PRSO – Project Radiation Safety Officer
RSRS – Radiological Survey and Remedial Services, LLC
SAP – Sampling and Analysis Plan
SOP – Standard Operating Procedure
TBD – to be determined
TtEC – Tetra Tech EC, Inc.
UFP-QAPP – Uniform Federal Policy for Quality Assurance Project Plans

9.0 QUALITY ASSURANCE OVERSIGHT

QA oversight for this project will include surveillance of field activities and the laboratories performing analysis. Planned project assessments, assessment findings and corrective action responses, and QA management reports are included in Tables B.9-1, B.9-2, and B.9-3, respectively.

9.1 FIELD SURVEILLANCE

The NAVFAC SW QA Officer and TtEC QCM may schedule surveillance of field activities at any time to evaluate the execution of sample collection, identification, and control in the field. The TtEC QC Program Manager will conduct surveillance of field activities at a minimum of once every six months. The surveillance will also include observations of COC procedures, field documentation, instrument calibrations, and field measurements.

Field documents and COC records will be reviewed to ensure that all entries are printed or written in indelible black or blue ink, dated, and signed. Sampling operations will be reviewed and compared to this SAP and other applicable SOPs. Use of proper sample containers, proper handling of samples, and adequate documentation of the sampling operation will be verified.

Field measurements will be reviewed by random spot-checking to determine that the instrument is within calibration, the calibration is done at the appropriate frequency, and the sensitivity range of the instrument is appropriate for the project.

9.1.1 Corrective Action

Findings identified during the field surveillance will be recorded on a surveillance checklist. A surveillance report will be prepared and provided to the PjM, who shall assign an individual to identify and implement corrective actions.

The TtEC QCM will monitor corrective action documentation, verify implementation of the corrective action, track and analyze the corrective action, and close out corrective action documentation upon completion of the corrective action.

9.2 LABORATORY ASSESSMENT

The off-site laboratory to be used for this project will have the qualifications described in Section 7.1.1. TtEC will only conduct a laboratory assessment if warranted during the project. The scope of the laboratory assessment by TtEC will be determined based on quality issues encountered.

TABLE B.9-1

PLANNED PROJECT ASSESSMENTS

(UFP-QAPP Worksheet #31)

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)	Person(s) Responsible for Responding to Assessment Findings (Title and Organizational Affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (Title and Organizational Affiliation)	Person(s) Responsible for Monitoring Effectiveness of Corrective Actions (Title and Organizational Affiliation)
Operational Readiness Review	Prior to mobilization of the project and prior to initiating major phases of work	Internal	TtEC	Project Manager, TtEC	Project Manager, TtEC	Project Manager, TtEC	PQCM, TtEC
Field Sampling Surveillance	Once at the beginning, once during, and once toward the end of field-sampling activities	Internal	TtEC	PQCM, TtEC	Project Manager, TtEC	Project Manager, TtEC	Project Manager and QCM, TtEC
On-site Laboratory Audit	Once every six months during project duration	Internal	TtEC	QCM, TtEC	On-site Laboratory Project Manager, NWT	On-site Laboratory Project Manager, NWT	QCM, TtEC
Data Review Surveillance (off-site laboratory data)	Once every six months during project duration	Internal	TtEC	Program Chemist, TtEC	Project Chemist, TtEC	Program Chemist, TtEC	QCM, TtEC
Data Review Surveillance (on-site laboratory data)	Once every six months during project duration	Internal	TtEC	PRSO, RSRS	RSO, TtEC	RSO, TtEC	QCM, TtEC
Management Review	Once during the project duration	Internal	TtEC	QCM, TtEC	Project Manager, TtEC	Project Manager, TtEC	PQCM, TtEC

Abbreviations and Acronyms:

NWT – New World Technologies, Inc.
PQCM – Project Quality Control Manager
PRSO – Project Radiation Safety Officer
QCM – Quality Control Project Manager
RSO – Radiation Safety Officer
RSRS – Radiological Survey and Remedial Services, LLC
TtEC – Tetra Tech EC, Inc.
UFP-QAPP – Uniform Federal Policy for Quality Assurance Project Plans

TABLE B.9-2

ASSESSMENT FINDINGS AND CORRECTIVE ACTION RESPONSES

(UFP-QAPP Worksheet #32)

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Organization)	Time Frame of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (Name, Title, Org.)	Time Frame for Response
Field Sampling Surveillance	Surveillance Report	Project Manager, TtEC	7 days after completion of the inspection	Corrective Action Report	Project Manager and QCM, TtEC	5 days after notification
Data Review Surveillance (off-site laboratory data)	Surveillance Report	QCM, TtEC	7 days after completion of the inspection	Corrective Action Report	QCM, TtEC	14 days after notification
Data Review Surveillance (on-site laboratory data)	Surveillance Report	QCM, TtEC	7 days after completion of the inspection	Corrective Action Report	QCM, TtEC	14 days after notification
Management Review	Surveillance Report	Project Manager, TtEC	7 days after completion of the inspection	Corrective Action Report	Project Manager, TtEC	14 days after notification

Abbreviations and Acronyms:

QCM – Quality Control Project Manager
TtEC – Tetra Tech EC, Inc.
UFP-QAPP – Uniform Federal Policy for Quality Assurance Project Plans

TABLE B.9-3

QA MANAGEMENT REPORTS

(UFP-QAPP Worksheet #33)

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)	Report Recipient(s) (Title and Organizational Affiliation)
Field Sampling Surveillance Report	Once at the beginning, once during, and once toward the end of field-sampling activities	TBD	PQCM, TtEC	Project Manager and QCM, TtEC
Data Review Surveillance Report (off-site laboratory data)	Once after all data are generated and reviewed	TBD	Program Chemist, TtEC	Project Manager and QCM, TtEC
Data Review Surveillance Report (on-site laboratory data)	Once after all data are generated and reviewed	TBD	RSO, TtEC	Project Manager and QCM, TtEC
Management Review Report	Once after management review is completed	TBD	QCM, TtEC	Project Manager and Program Manager, TtEC

Abbreviations and Acronyms:

PQCM – Project Quality Control Manager
QCM – Quality Control Project Manager
RSO – Radiation Safety Officer
TBD – to be determined
TtEC – Tetra Tech EC, Inc.
UFP-QAPP – Uniform Federal Policy for Quality Assurance Project Plans

10.0 SAP REVISION OR AMENDMENT

Significant change in work scope affecting the original project DQOs will require this SAP to be amended. Any changes to this SAP will be documented prior to sampling and analysis activities. Minor changes will be documented by completing an FCR form that must be approved prior to field implementation. Major changes to work scope affecting the original DQOs or meeting criteria described in *EWI #2, 3EVR.2, Review, Approval, Revision, and Amendment of Sampling and Analysis Plans (SAPs)* (NAVFAC SW, 2006) will require preparation of a SAP addendum. The SAP addendum must be approved by NAVFAC SW QAO prior to conducting sampling and analysis.

11.0 REFERENCES

Atomic Energy Commission (AEC). 1974. *Regulatory Guide 1.86*. Termination of Operating Licenses for Nuclear Reactors. June.

Department of Defense (DoD). 2006. *Quality Systems Manual for Environmental Laboratories*. Version 3. January.

Department of Defense, Department of Energy, Nuclear Regulatory Commission, U.S. Environmental Protection Agency (EPA). 2000. *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM), *NUREG-1575*. August.

Department of the Navy (DON). 2006. *Final Basewide Radiological Removal Action, Action Memorandum–Revision 2006*. Hunters Point Shipyard, San Francisco, California.

Naval Facilities Engineering Command Southwest (NAVFAC SW). 2006. *Environmental Work Instruction (EWI) #2, 3EVR.2, Review, Approval, Revision, and Amendment of Sampling and Analysis Plans (SAPs)*. April.

Naval Facilities Engineering Command – Southwest (NFECSW). 2005. *Environmental Work Instruction (EWI) EVR.6, Environmental Data Management and Required Electronic Delivery Standards*. April.

Naval Facilities Engineering Service Center (NFESC). 1999. *Navy Installation Restoration Chemical Data Quality Manual* (IRCDQM). October.

Naval Sea Systems Command (NAVSEA). 2004. *Final Historical Radiological Assessment, Volume II*. August 31.

Southwest Division Naval Facilities Engineering Command (SWDIV). 2001. *Environmental Work Instruction (EWI) #1, 3EN2.1, Chemical Data Validation*. November.

Tetra Tech FW, Inc. 2005. *Base-wide Radiological Work Plan*.

United States Army Corps of Engineers (USACE). *Safety and Health Requirements* (EM-385-1-1), and all applicable Occupational Safety and Health Administration (OSHA).

U.S. Environmental Protection Agency (EPA). 1980. Gamma Emitting Radionuclides by Gamma Ray Spectroscopy, Prescribed Procedures for Measurement of Radioactivity in Drinking Water (EPA/600/4-80-032).

_____. 1992. *Specification and Guidance for Obtaining Contaminant-Free Sample Containers,* EPA 540/R-93/051 and OSWER Directive 9240.0-05A.

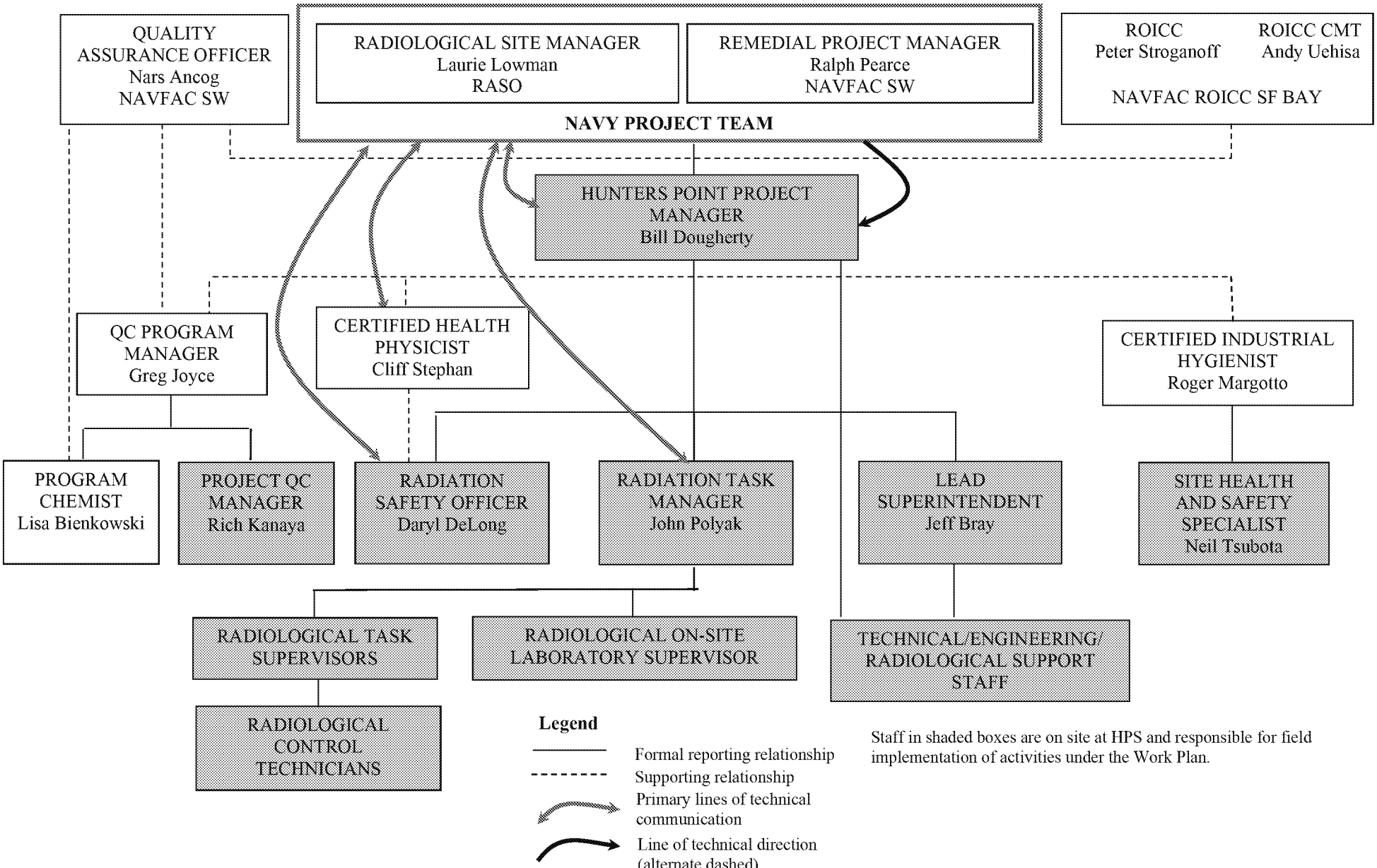
_____. 2000. *Radionuclides Notice of Data Availability Technical Support Document*. Targeting and Analysis Branch, Standards and Risk Management Division, Office of Groundwater and Drinking Water, EPA. March.

_____. 2005. *Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP)*. March.

FIGURES

FIGURE B.2-1

PROJECT ORGANIZATION CHART



ATTACHMENT 1

EXAMPLE OF SAMPLE LABEL, CUSTODY SEAL, AND CHAIN-OF-CUSTODY FORM

TETRA TECH
1230 Columbia Street, Suite 500
San Diego, CA 92101 (619) 234-8696

NUMBER 21700

CHAIN-OF-CUSTODY RECORD

PROJECT NAME	PURCHASE ORDER NO.	ANALYSES REQUIRED	LABORATORY NAME
PROJECT LOCATION	PROJECT NO.		
SAMPLER NAME	AIRBILL NUMBER		LABORATORY ID (FOR LABORATORY)
PROJECT CONTACT	PROJECT CONTACT PHONE NUMBER		

Project Information Section Do not submit to Laboratory

SAMPLE ID	DATE COLLECTED	TIME COLLECTED	NO. OF CONTAINER	LEVEL 3	LEVEL 4	TYPE	TAT	COMMENTS	LOCATION	DEPTH START	DEPTH END	QC

RELINQUISHED BY (Signature)	DATE	RECEIVED BY (Signature)	LABORATORY INSTRUCTIONS/COMMENTS
COMPANY	TIME	COMPANY	
RELINQUISHED BY (Signature)	DATE	RECEIVED BY (Signature)	COMPOSITE DESCRIPTION
COMPANY	TIME	COMPANY	
RELINQUISHED BY (Signature)	DATE	RECEIVED BY (Signature)	SAMPLE CONDITION UPON RECEIPT (FOR LABORATORY)
COMPANY	TIME	COMPANY	TEMPERATURE: _____ SAMPLE CONDITION: ☐ INTACT ☐ BROKEN COOLER SEAL: ☐ INTACT ☐ BROKEN

SAMPLING COMMENT:

White - Laboratory; Pink - Laboratory; Canary - Project File; Manila - Data Management

SAMPLE LABEL (EXAMPLE)

SAMPLE NO.:_____
PROJECT:_____
DATE:____/____/____ **TIME:**_____**HRS**_____
MEDIUM: WATER_____ **SOIL**_____ **SEDIMENT**_____
OTHER_____**(Specify)**
TYPE: GRAB_____ **COMPOSITE**_____ **OTHER**_____
PRESERVATION:_____
ANALYSIS:_____
SAMPLED BY:_____
REMARKS:_____
_____

CUSTODY SEAL (EXAMPLE)

CUSTODY SEAL

Person Collecting Sample:_____ Sample No.:_____
(Signature)
Date Collected:_____ Time_____

ATTACHMENT 2

HUNTERS POINT SHIPYARD
STANDARD OPERATING PROCEDURES

FINAL

HUNTERS POINT SHIPYARD PROJECT

Standard Operating Procedure

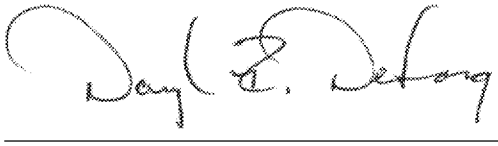
SAMPLING PROCEDURES FOR RADIOLOGICAL SURVEYS

HPO-Tt-009

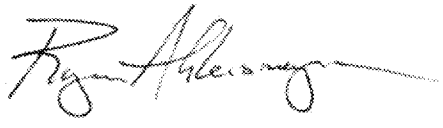
DCN: FWSD-RAC-O5-0473

Revision 1

Approved By:



Radiation Safety Officer — 08/13/07 — Date



Project Manager — 08/13/07 — Date

REVISION HISTORY

Revision (Date)	*Rev. No*	*Prepared By*	*Description of Changes*	*Affected Pages*
February 16, 2005	0	L. Bienkowski	Issued Final	All
April 25, 2006	1	L. Bienkowski	Updated contractor name from Tetra Tech FW, Inc. to Tetra Tech EC, Inc.	

TABLE OF CONTENTS

1.0 PURPOSE

This procedure will be used by Tetra Tech EC, Inc. (TtEC) personnel and its subcontractors at Hunters Point Shipyard (HPS) to perform swipe sampling and sampling of various types of media including soil, sediment, solid material (such as concrete, brick, porcelain, wood), and water. This procedure also details sample packaging and transporting samples to the laboratory.

2.0 SCOPE

This procedure shall be implemented by TtEC staff and subcontractor personnel when collecting samples on field projects related to radiological surveys at HPS.

3.0 MAINTENANCE

The Program Chemist is designated as the procedure owner and is responsible for updating this procedure. Final approval authority rests with the Project Manager.

4.0 RESPONSIBILITIES

The following personnel (or their qualified designee) will be directly involved with the sampling procedures discussed herein.

Program Chemist - The Program Chemist is responsible for updating this procedure as necessary. In addition, the Program Chemist will coordinate with the Radiation Task Manager (RTM) to ensure that samples are collected in conjunction with this procedure.

Radiation Task Manager – The RTM is responsible for ensuring that the conditions of this procedure are complied with during project sampling operations. The RTM shall ensure, by periodic personal observation, that samples are collected appropriately and chain-of-custody (COC) is controlled as described in this procedure. The RTM will also ensure that Radiological Control Technicians (RCTs) are qualified by training and experience to perform the requirements of this procedure and ensure that personnel under their cognizance observe proper precautions. The RTM will make a copy of this procedure available to the RCTs.

Radiation Safety Officer – The Radiation Safety Officer (RSO) is responsible for training personnel working with radioactive material. The RSO is responsible for the overall implementation and compliance with this procedure during all project operations. The RSO shall conduct periodic reviews, via personal observation of conducting radiation and contamination surveys, to ensure adherence to the requirements of this procedure.

Radiological Task Supervisor – The Radiological Task Supervisor (RTS) shall be responsible for assisting in the assignment of personnel that will perform the tasks required by this procedure. The RTS is responsible for the control of radioactive material samples, supervision of RCT's performing the requirements of this procedure, and to ensure that personnel under their cognizance observe proper precautions.

Radiological Control Technician – The Radiological Control Technician (RCT) shall be responsible for the performance of the requirements of this procedure and documentation of work performed. The RCT shall ensure compliance with this and any other referenced procedure.

5.0 DEFINITIONS AND ABBREVIATIONS

Swipe Samples – Swipe samples are materials, which after being wiped over a surface, are analyzed to determine the presence of removable radioactivity on the surface area that was wiped.

Soil Samples – Soil samples are defined as soil collected for analytical purposes. Soil samples will be collected from the top 15 centimeters (cm) of the surface, unless otherwise noted in the applicable work-planning document [e.g. a Task-specific Plan (TSP), Work Instruction or Work Plan].

Sediment Samples – Sediment samples are defined as a collection of clay, silt, sand, and/or gravel deposited by water, wind, or glaciers used for analytical purposes.

Solid Material Samples – Solid material samples are defined as pieces of concrete, brick, porcelain, wood, or any other hard material collected for analytical purposes from buildings or surrounding areas. The samples could include accumulations from ventilation systems or drain systems.

Liquid Samples – Liquid samples are defined as liquid collected for analytical purposes from sinks, drain piping, sewer systems, rinsate, groundwater, leachate, liquid investigation-derived waste, and low-point accumulation areas inside of buildings, sumps, and excavation pits.

6.0 SAMPLING PROCEDURE DETAILS

6.1 GENERAL PROCEDURES

Field instruments used for measurements required by this procedure shall be checked with standards and verified to have current calibration.

Anytime this procedure is in effect, the RTM (or qualified designee) should ensure, by periodic personal observation, that samples are appropriately collected and controlled.

Surface scan surveys are to be performed at each location before initiating sampling. This will identify the presence of gross contamination, which will require that samples and equipment be treated as radioactive and handled in accordance with applicable license requirements. Samples will be recorded on COC documentation.

6.2 SAMPLING PROCEDURE PROCESS

Sample activities will be recorded in the field logbook as directed by the Base-wide Sampling and Analysis Plan (SAP). Sampling personnel will don a new pair of disposable nitrile gloves immediately before collecting samples at each location.

6.2.1 SWIPE SAMPLING

Swipe samples will be obtained in accordance with HPO-Tt-006, *Radiation and Contamination Surveys*. Swipe samples will be documented in the sample logbook as applicable. Sample COC records shall be completed in accordance with the Base-wide SAP.

6.2.2 SOIL SAMPLING

Because standard surface soil contamination criteria for radionuclides are applicable to the average concentration in the upper 15 cm of soil, the sampling protocol described here is based on obtaining a sample of this upper 15 cm. Special situations, such as sampling at depths greater than 15 cm, evaluating trends or airborne deposition, determining near-surface contamination profiles, and measuring non-radiological contaminants, may require special sampling procedures. These special situations will be evaluated and incorporated into TSPs as the need arises.

Samples will be collected with a hand-auger, hollow-stem auger, split-spoon sampler, disposable scoop, or equivalent. The soil removed for sampling must be sufficient to yield a sample of sufficient volume for the sample container being used. Soil samples will be collected and handled as follows:

1. Loosen the soil at the selected sampling location to a depth of approximately 15 cm, using a trowel or other digging instrument.
2. Remove large rocks, vegetation and foreign objects. In some cases, however, these objects may be the source of the contamination and may be collected as separate samples for characterization.
3. Place as much soil as practical into a 250-milliliter (mL)-wide mouth plastic bottle or plastic 500-mL Marinelli container.

4. If sample containers are not readily available, samples may be collected in a plastic bag for subsequent transport to the laboratory for sample preparation.
5. Tape the cap of the container in place or seal the ziplock plastic bag.
6. Label the sample container in accordance with the Base-wide SAP.
7. Document all samples collected in the sample logbook as applicable. Sample COC records shall be completed in accordance with the Base-wide SAP.
8. Transport samples to the on-site laboratory for analysis as soon as possible after sample collection. Sample packaging and shipment procedures for transporting samples to an off-site laboratory are described in Section 6.3 of this procedure.
9. Clean or decontaminated tools will be used at each sampling location. Sampling tools will be decontaminated as described in the Base-wide SAP.

6.2.3 SEDIMENT SAMPLING

Several methods are available to collect sediment samples. The tools used will be appropriate to the circumstances and may include use of trowels, augers, or other hand tools. Sediment sampling will be conducted as follows:

1. A hand-auger, trowel or similar device will be used to access each sampling location. The sample collection tool will be selected based on physical limitations accessing the sample location.
2. Place as much material as practical into a 250-mL-wide mouth plastic bottle or plastic 500-mL Marinelli container.
3. Follow steps 4 through 9 of Section 6.2.2 to complete sample collection.

6.2.4 SOLID MATERIAL SAMPLING

Several methods are available to collect solid material samples. To collect samples, solid materials may need to be broken into smaller pieces. Solid materials will be collected as follows:

1. Break up the material into small enough pieces to fill a 250-mL-wide mouth plastic bottle or plastic 500-mL Marinelli container.
2. Follow steps 4 through 9 of Section 6.2.2 to complete sample collection.

6.2.4.1 Pipe and Drain Line Sampling

Pipe and drain line sampling is conducted to assess residual radioactivity that may be inside of drain lines or materials within sanitary sewer and storm drain systems.

1. Since the type of material found inside drain lines varies, there is no specific method identified to collect these samples. Samples may be collected using a plumber's snake, swabs, scraper, trowel, etc.
2. As much material as possible should be collected and placed into a 250-mL-wide mouth plastic bottle or plastic 500-mL Marinelli container
3. Follow steps 4 through 9 of Section 6.2.2 to complete sample collection.

6.2.4.2 Ventilation Sampling

Ventilation sampling will be performed to identify if the system is impacted and assess the residual radioactivity that may be present.

1. If visible dust is present inside the ventilation system, use a masslin cloth to accumulate the material into a pile. (If no visible dust is present, collect a swipe sample as discussed in HPO-Tt-006, *Radiation and Contamination Surveys*.)
2. Using a flat utensil such as a piece of paper or scraper carefully place as much material as possible into a 250-mL-wide mouth plastic bottle or plastic 500-mL Marinelli container.
3. Follow steps 4 through 9 of Section 6.2.2 to complete sample collection.

6.2.5 WATER SAMPLING

Water samples will be collected as follows:

1. Collect water using any of the following sampling equipment: disposable bailer, pump, coliwassa-type tube sampler, or equivalent. Care will be taken to avoid collection of bottom sediment or vegetation.
2. Fill completely a 250-mL-wide mouth plastic bottle, plastic 500-mL Marinelli container or two liter plastic bottles.
3. Follow steps 5 through 9 of Section 6.2.2 to complete sample collection.

6.3 SAMPLE PACKAGING AND TRANSPORT

Samples will be delivered for analysis to an on-site laboratory via a box, cooler, or similar container (ice is not required if only radiological analysis will be performed) along with the completed COC. Upon arrival at the on-site laboratory, the sampler will sign the "Relinquished By" on the COC, and the laboratory manager will sign the "Received By" on the COC. The white copy of the COC will be submitted with the final analytical report of data from the on-site laboratory to the TtEC project chemist, the pink and yellow copies will be maintained by the on-site laboratory for their project files, and the manila copy will be submitted to the TtEC project chemist. A duplicate of the manila copy may also be kept in the TtEC project file on site.

Ten percent of the solid or liquid samples analyzed by the on-site laboratory will be sent to an off-site laboratory for quality assurance purposes. Additional samples may be sent for off-site analysis, as described in applicable work planning documents. A new COC will be generated by the laboratory manager for samples designated for off-site laboratory analysis. Samples designated for transport off site will be packaged in accordance with applicable Department of Transportation (DOT) and International Air Transport Association (IATA) procedures. At a minimum, sample containers will be placed in a box, cooler, or similar container for shipment and packaged with bubble wrap or other materials as necessary to prevent container breakage.

For samples transported by an off-site laboratory courier, two custody seals will be taped across the lid of the box or cooler: one seal in the front and one seal in the back. The appropriate section(s) of the COC will be completed by the assigned courier. The box/cooler and the top two copies (white and pink) of the COC will then be released to the courier for transportation to the laboratory.

For samples shipped via a commercial carrier, the COC will include the airbill number, and the "Received By" box will be labeled with the commercial courier's name. The top two copies (white and pink) of the COC will be sealed in a resealable bag and then taped to the inside of the sample cooler lid or placed inside the box. The yellow copy of the COC will be maintained by the on-site laboratory and the manila copy will be submitted to the TtEC project chemist. A duplicate of the manila copy may also be kept in the TtEC project file on site. The box/cooler will be taped shut with strapping tape as necessary. Two custody seals will be taped across the lid: one seal in the front and one seal in the back. The pouch for the airbill will be placed on the box/cooler and secured with clear tape. The airbill will be completed for priority overnight delivery and placed in the pouch. If multiple boxes/coolers are being shipped, then the original airbill will be placed on the box/cooler with the COC, and copies of the airbill will be placed on the other boxes/coolers. The number of packages should be included on each airbill (1 of 2, 2 of 2). Saturday deliveries should be coordinated in advance with the designated off-site laboratory and placement of "Saturday Delivery" stickers on each box and/or cooler to be shipped should be confirmed with the commercial courier prior to release. Prepared packages will also be surveyed prior to shipment.

7.0 RECORDS

Sample collection records will include field logbooks and COCs. These records will be completed and maintained in accordance with the Base-wide SAP.

8.0 REFERENCES

Number	*Title*
DCN: FWSD-RAC-05-0165	*Final Base-wide Radiological Sampling and Analysis Plan, Revision 0, February 16, 2005*
HPO-Tt-006	*Radiation and Contamination Surveys*

9.0 ATTACHMENTS

None.